

## 添付資料 6: 固定翼ドローン操作研修資料



គម្រោងអភិវឌ្ឍន៍សេដ្ឋកិច្ច  
ក្នុងការគ្រប់គ្រងធនធានធម្មជាតិប្រកបដោយនិរន្តរភាព នៅថ្នាក់ជាតិ និងថ្នាក់ក្រោមជាតិ  
(ក្រសួងបរិស្ថាន-ទីភ្នាក់ងារសហប្រតិបត្តិការអន្តរជាតិជប៉ុន-រដ្ឋបាលព្រៃឈើ)



## វគ្គបណ្តុះបណ្តាលរយៈពេលខ្លីស្តីពី “ការប្រើប្រាស់ជ្រុង អ៊ីប៊ី ជីអូ ដើម្បីធ្វើផែនទីរូបភាពពីលើអាកាស”

### មាតិកា

- ការណែនាំអំពីវគ្គបណ្តុះបណ្តាល
- ការប្រើប្រាស់ជ្រុងក្នុងវិស័យផ្សេងៗ
- ជ្រុងអ៊ីប៊ី ជីអូ និងជីអូបែស
- ការណែនាំអំពីការរៀបចំការហោះហើរជ្រុង អ៊ីប៊ី ជីអូ
- ការណែនាំអំពីផែនការហោះហើរសម្រាប់ អ៊ីប៊ី ជីអូ
- ការរៀបចំទីតាំងហោះហើរ
- ការណែនាំអំពីសុវត្ថិភាពនិងការប្រុងប្រយ័ត្ន
- ការណែនាំអំពីការប្រតិបត្តិការ
- ការហោះហើរសាកល្បងនៅក្នុងកម្មវិធី អ៊ីម៉ូសិន
- ការអនុវត្តជាក់ស្តែងនៅទីវាល

### ការណែនាំអំពីវគ្គបណ្តុះបណ្តាល

- គោលបំណងនៃវគ្គបណ្តុះបណ្តាលនេះ៖
  ១. យល់ដឹងអំពីបច្ចេកទេស ក្នុងការរៀបចំផែនការ មុនចាប់ផ្តើមការហោះហើរជ្រុង
  ២. យល់ដឹងអំពីបច្ចេកទេសក្នុងការរៀបចំការហោះហើរ ការបង្ហោះ និងការគ្រប់គ្រង ជ្រុង អ៊ីប៊ី ជីអូ
- ការពឹងផ្អែកនៃវគ្គបណ្តុះបណ្តាលនេះ៖
  ១. អាចរៀបចំផែនការហោះហើរទីវាលបានដោយត្រឹមត្រូវ និងប្រកបដោយសុវត្ថិភាព
  ២. ទទួលបានចំណេះដឹងពីបច្ចេកទេសនៃការប្រើប្រាស់ជ្រុងដើម្បីប្រមូលយកទិន្នន័យពីលើអាកាស



### ការប្រើប្រាស់ជ្រុងក្នុងវិស័យផ្សេងៗ

#### □ តើទិន្នន័យអ្វីខ្លះដែលអាចទទួលបានពីជ្រុង ? ហេតុអ្វីបានជាទិន្នន័យជ្រុងមានសារៈសំខាន់ ?

- ជ្រុង ឬ Unmanned Aerial Vehicle (UAV) សំដៅទៅលើយន្តហោះដែលគ្មានមនុស្សបើក វាអាចដំណើរការដោយស្វ័យប្រវត្តិទៅតាមផែនការហោះហើរដែលត្រូវបានកំណត់ ឬតាមរយៈការបញ្ជាដោយប្រើប្រាស់ដៃបញ្ជាជ្រុង។ ទិន្នន័យពីជ្រុងជា រូបថត វីដេអូ ជីអូសេសបស់ជ្រុង ចំណែកទិន្នន័យពីការដំណើរការរូបថតមានដូចជា៖ Orthomosaic, 3D point cloud, Digital surface model (DSM) និង Contour lines។
- ជាទូទៅប្រភេទជ្រុងត្រូវបានកំណត់ជាបី៖
  - ជ្រុងប្រើប្រាស់សម្រាប់តែ រដ្ឋាភិបាល (វិស័យយោធា)
  - ជ្រុងប្រើទាក់ទងនឹងការងារពាណិជ្ជកម្ម (Commercial Drone)
  - ជ្រុងដែលប្រើលើការកំសាន្ត
- ជ្រុងធំៗចំនួនបួនប្រភេទដែលត្រូវតែប្រើ៖
  - ជ្រុងដែលមានម៉ូទ័រច្រើន (Multi-Rotor Drones)
  - ជ្រុងដែលមានលក្ខណៈស្រដៀងយន្តហោះ (Fixed-Wing Drones)
  - ជ្រុងដែលប្រើម៉ូទ័រមួយ (Single-Rotor Drones)
  - ជ្រុងដែលមានលក្ខណៈស្រដៀងយន្តហោះ តែភ្ជាប់ជាមួយបច្ចេកទេសហោះហើរនឹងចុះចតតាមទិសបញ្ឈរ (Fixed-Wing Hybrid VTOL)

### ការប្រើប្រាស់ជ្រុងក្នុងវិស័យផ្សេងៗ (ត)

រូបទី១៖តារាងប្រៀបធៀបជ្រុង និងការប្រើប្រាស់

| ប្រភេទជ្រុង                                                                    | គុណសម្បត្តិ                                                                                              | គុណវិបត្តិ                                                                                                                                                                   | ការប្រើប្រាស់                                                                                            |
|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| ជ្រុងដែលមានម៉ូទ័រច្រើន                                                         | - ងាយស្រួលក្នុងការគ្រប់គ្រង<br>- ងាយស្រួលក្នុងការបែកម៉ាស៊ីន<br>- ងាយស្រួលក្នុងថតជិតការសាងសង់ និងអាគារ    | - រយៈពេលនៃការហោះមានកំណត់<br>- ការថយចុះដើម្បីផលិតផែនទីក្នុងទំហំបំរើនៅមានកំរិត<br>- ប្រើប្រាស់ថាមពលច្រើនដើម្បីទប់លំនឹង                                                         | - ការត្រួតពិនិត្យ (ការផ្ទៀងផ្ទាត់...)<br>- របាយការណ៍សុខភាពរុក្ខជាតិ<br>- ថតរូប និងវីដេអូ<br>- ថតស្ថាន 3D |
| ជ្រុងដែលមានលក្ខណៈស្រដៀងយន្តហោះ                                                 | - ការហោះហើរបានឆ្ងាយ<br>- ថតរូបផលិតផែនទីក្នុងទំហំធំ<br>- ការហោះហើរបានយូរ<br>- អាចហោះបានរយៈកម្ពស់ខ្ពស់     | - តម្លៃបស់ជ្រុងថ្លៃ<br>- តម្លៃការបណ្តុះបណ្តាល ដើម្បីចាត់ថ្នាក់ការហោះហើរ និងការចុះចតប្រកបដោយសុវត្ថិភាព<br>- ការថតរូបត្រូវតែដាក់ចំណុចចាប់ផ្តើម នៅមានដំណាក់កាលច្រើនទៀតត្រូវធ្វើ | - ការផលិតផែនទី<br>- ការវាស់វែង<br>- កសិកម្ម<br>- ការត្រួតពិនិត្យ<br>- ការសាងសង់<br>- សន្តិសុខ            |
| ជ្រុងដែលប្រើម៉ូទ័រមួយ                                                          | - ការហោះហើរបានយូរ<br>- ការហោះហើរក្នុងកំរិតសំរេចបានល្អ<br>- ប្រើដើម្បីភ្ជាប់ជាមួយការមើលទទួលបាននូវទិន្នន័យ | - តម្លៃបស់ជ្រុងថ្លៃ<br>- តម្លៃការពេលវេលាច្រើនដើម្បីការថែទាំ<br>- ការថយចុះមានសកលស្រួល ដែលងាយបង្កគ្រោះថ្នាក់                                                                   | - ថតស្ថាន LIDAR<br>- ការវាស់វែង<br>- ប្រើសម្រាប់ភ្ជាប់ការមើលទទួលបាននូវទិន្នន័យ                           |
| ជ្រុងដែលមានលក្ខណៈស្រដៀងយន្តហោះ តែភ្ជាប់ជាមួយបច្ចេកទេសហោះហើរនឹងចុះចតតាមទិសបញ្ឈរ | - អាចប្រើប្រាស់លើគ្រប់ការងារលើបាត់ដោយស្រួល                                                               | - មិនសូវមាននៅលើទីផ្សារ<br>- បច្ចេកទេសផលិតស្ថិតនៅក្នុងដំណាក់កាលដំបូងនៅឡើយ                                                                                                     | - ជ្រុងដឹកជញ្ជូន                                                                                         |

### ការប្រើប្រាស់ជ្រុងក្នុងវិស័យផ្សេងៗ (ត)

#### □ នៅក្នុងកិច្ចការការពារនិងអភិរក្សធនធានធម្មជាតិ ជ្រុងត្រូវបានប្រើប្រាស់លើមុខងារ៖

- ពិនិត្យនិងតាមដានបម្រែបម្រួល ប្រព័ន្ធអេកូឡូស៊ី
- ពិនិត្យនិងតាមដានសត្វព្រៃ
- ការផលិតផែនទីដីកសត្វព្រៃ
- ការត្រួតពិនិត្យនិងការការពារបេឡេស
- ទេសចរណ៍ធម្មជាតិ
- ការធ្វើផែនទីទំហំនៃភ្លើងព្រៃ
- និងការធ្វើសារពើភ័ណ្ឌព្រៃឈើ ...។



ជ្រុងអ៊ីប៊ី ជីអូ និងជីអូបែស



តើនៅក្នុងការប្រើប្រាស់មានអ្វីខុស?

- ថ្មចំនួនពីរ ដែលថ្មមួយអាចហោះហើរបាន៤៥នាទីសម្រាប់ថ្មមួយ
- ជ្រុង eBee Geo ដែលមានភ្ជាប់ជាមួយ ឧបករណ៍សម្រាប់វាស់ល្បឿនខ្យល់ អង់គែនសម្រាប់បញ្ជូនព័ត៌មានរបស់ជ្រុងមកកុំព្យូទ័រ អង់គែន GNSS ហើយជ្រុងនេះក៏ត្រូវបានភ្ជាប់កង្វាជាមួយកៅស៊ូចំនួនបី
- ម៉ូឌីមសម្រាប់បញ្ជូនព័ត៌មានទៅជ្រុង
- ការមេកា S.O.D.A
- ឆ្នាំងសាកស្ទាតអ៊ី
- ខ្សែសម្រាប់បញ្ជូនថ្ម ការសម្រាប់ប៊ីច ខ្សែសាកថ្ម ខ្សែភ្ជាប់ម៉ូឌីមទៅកុំព្យូទ័រ
- នៅផ្នែកខាងលើ មានស្លាបចំនួនពីរ
- នៅផ្នែកខាងក្រោម មានសៀវភៅណែនាំអំពីការប្រើប្រាស់ជ្រុង ការបញ្ជូនថ្ម និងតារាងត្រួតពិនិត្យ
- នៅផ្នែកខាងក្រោមនេះដែរ មានកង្វាចំនួនពីរ កៅស៊ូចំនួនដប់ តួណ័រស៊ែ ខ្នាត និងឧបករណ៍សម្រាប់វាស់ល្បឿនខ្យល់។

7

ជ្រុងអ៊ីប៊ី ជីអូ និងជីអូបែស (ត)

ឧបករណ៍ភ្ជាប់មកជាមួយ៖



ឧបករណ៍តាមដាន



GeoBase

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ជ្រុងអ៊ីប៊ី ជីអូ និងជីអូបែស (ត)



- ជ្រុងអ៊ីប៊ី ជីអូ គឺជាប្រភេទជ្រុង fixed wing ដែលបានរចនាមកសំរាប់បំពេញតម្រូវការ អ្នកវាស់វែង ស្វ័យគ្រប់គ្រង និងអ្នកជំនាញ GIS។
- ជ្រុងនេះមានសមត្ថភាពអាចហោះបាន ៤៥នាទី
- កម្រិតលម្អៀងតិចជាង 2.5 cm
- ភ្ជាប់មកជាមួយការមេកា S.O.D.A របស់ក្រុមហ៊ុន senseFly
- រូបរាងរបស់វា ស្រាលនិងមានភាពងាយស្រួលក្នុងការយកទៅទីវាល
- សុវត្ថិភាព និងងាយស្រួលប្រើ។

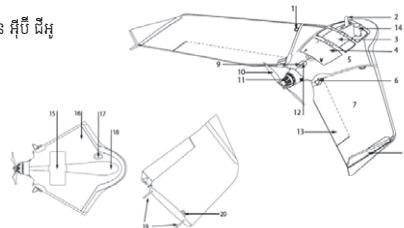


- ការមេការបស់ជ្រុងនេះអាចប្រើប្រាស់លើ៖
  - ការវាស់វែង និងការចុះបញ្ជីដី
  - ផែនការអភិវឌ្ឍន៍ទីក្រុង
  - ការគ្រប់គ្រងដី
  - ការពិនិត្យនិងតាមដានបញ្ហាបរិស្ថាន
  - ការគ្រប់គ្រងគ្រោះមហន្តរាយ
  - និងការប្រើប្រាស់លើវិស័យព្រៃឈើ

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ជ្រុងអ៊ីប៊ី ជីអូ និងជីអូបែស (ត)

❑ តួរបស់ជ្រុង អ៊ីប៊ី ជីអូ



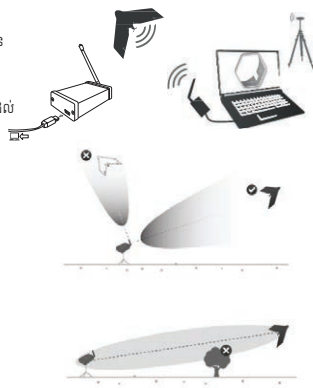
- |                             |                              |                          |
|-----------------------------|------------------------------|--------------------------|
| 1. គន្លឹះដកស្រោប            | 8. ស្លាបតូច                  | 15. កន្លែងលើកការមេកា     |
| 2. ស្ថានភាព LED/pilot probe | 9. កន្លែងបញ្ចេញពន្លឺ Strobe  | 16. គូរកណ្តាល            |
| 3. កន្លែងដាក់ថ្ម            | 10. កង្វារ                   | 17. ឧបករណ៍វាស់ស្ទង់ភាពងឺ |
| 4. កន្លែងដាក់ការមេកា        | 11. ម៉ូទ័រ                   | 18. ថ្នាំងទឹក            |
| 5. គូរកណ្តាល                | 12. ឧបករណ៍វាស់សីតុណ្ហភាព     | 19. ខ្សែភ្ជាប់ស្លាប      |
| 6. យន្តការភ្ជាប់ Servo      | 13. កន្លែងគ្រប់គ្រងការហោះហើរ | 20. គន្លឹះដកស្រោប        |
| 7. ស្លាប                    | 14. អង់គែន GNSS              |                          |

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ជ្រុងអ៊ីប៊ី ជីអូ និងជីអូបែស (ត)

❑ ម៉ូឌីមទំនាក់ទំនងទៅជ្រុង

- ម៉ូឌីមមានតួនាទីទទួលព័ត៌មានពីជ្រុង និងបញ្ជូនព័ត៌មានទៅជ្រុង
- ប្រសិនបើអ្នកភ្លេចភ្ជាប់វានោះ ជ្រុងមិនអាចហោះហើរបានទេ
- អ្នកត្រូវដំឡើងយ៉ាងតិចមួយម៉ូឌីម
- សូមជៀសវាងកុំអោយជ្រុងហោះនៅពីលើ ព្រោះវាអាចប៉ះពាល់ដល់ការបញ្ជូនព័ត៌មាន



រូបភាព បង្ហាញពីពន្លឺនៃសេវា

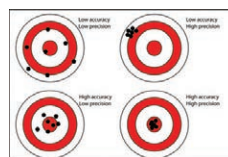
11

ជ្រុងអ៊ីប៊ី ជីអូ និងជីអូបែស (ត)



- ជីអូបែស (GeoBase)៖ ត្រូវបានប្រើប្រាស់ដើម្បីភ្ជាប់ទីតាំងជាក់លាក់ណាមួយ (និយមការទីតាំងច្បាស់លាស់កំណត់ដោយម៉ាស៊ីនវាស់វែង) ទៅជ្រុងសម្រាប់ដំណើរការវិធីសាស្ត្រវាស់វែងដោយ RTK។

- ❖ អ្វីជា កម្រិតលម្អៀតនៃ GPS?
- ❖ អ្វីជា Real-time kinematic positioning (RTK)?



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ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

- ❖ ការហោះហើរជ្រួន អ៊ីប៊ីជីអូបែកជាបីដំណាក់កាល៖
  - ដំណាក់កាលមុនពេលហោះហើរ៖
    - សិក្សាអំពីទីតាំងដែលត្រូវហោះហើរ
    - ស្វែងរកទីតាំងសុវត្ថិភាពដើម្បីចុះចតនិងហោះហើរ
    - ត្រួតពិនិត្យសម្ភារៈប្រើប្រាស់នៅទីវាល
    - ដំឡើងកម្មវិធី អ៊ីម៉ូសិន និងធ្វើបច្ចុប្បន្នភាពសេរី
    - បញ្ចូលថ្មីអោយបានត្រឹមត្រូវ
  - ដំណាក់កាលហោះហើរ៖
    - រៀបចំទីតាំងហោះហើរ
    - ចាប់ផ្តើមការហោះហើរ
  - ដំណាក់កាលក្រោយពេលហោះហើរ៖
    - រក្សាទុកទិន្នន័យនៅក្នុងអង្គចងចាំ
    - ចាប់ផ្តើមដំណើរការទិន្នន័យដំបូង
    - រៀបចំសម្ភារៈទាំងអស់អោយបានត្រឹមត្រូវ

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ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

- ❖ ការណែនាំអំពីផែនការហោះហើរសម្រាប់ អ៊ីប៊ី ជីអូ៖
  - ដើម្បីការហោះហើរប្រកបដោយសុវត្ថិភាពយើងត្រូវ៖
    - កំណត់ទីតាំងហោះហើរច្បាស់លាស់ ដោយពិនិត្យមើលតាមរយៈរូបភាពផ្ទាយពេល និងចុះទៅទីតាំងផ្ទាល់
    - សាកសួរអាជ្ញាធរមានសមត្ថកិច្ចនៅទីនោះ អនុញ្ញាតិអោយហោះហើរដែរឬទេ
    - ពិនិត្យមើលឧបសគ្គដែលអាចប៉ះពាល់ឬការខានដល់ការហោះហើរ
    - ពិនិត្យមើលទីតាំងចុះចតបានត្រឹមត្រូវ (កន្លែងដែលមានស្មៅដុះទំហំប្រហែលតារាងបាល់ទាត់)
    - កំណត់ទីតាំងនិយាមការអោយបានត្រឹមត្រូវ
    - ពិនិត្យមើលអាកាសធាតុ ភ្លៀងធ្លាក់ និងល្បឿននៃខ្យល់បក់។



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ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

- ❖ ការណែនាំអំពីផែនការហោះហើរសម្រាប់ អ៊ីប៊ី ជីអូ (ត)៖
 

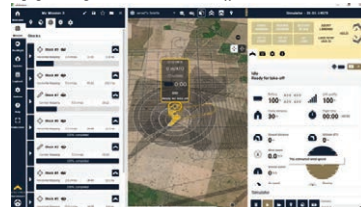
តារាងទី២ សម្ភារៈចាំបាច់សម្រាប់ការរៀបចំការហោះហើរ

| ល.រ | ឈ្មោះសម្ភារៈ        | ចំនួន | ផ្សេងៗ |
|-----|---------------------|-------|--------|
| 1   | eBee Geo            | 1     |        |
| 2   | Geobase             | 1     |        |
| 3   | ជើងបណ្ណ (Base)      | 1     |        |
| 4   | ជើងទប់ (Base)       | 1     |        |
| 5   | តង់សម្រាប់ចុះចត     | 1     |        |
| 6   | ឆ័ត្រតូច            | 1     |        |
| 7   | ម៉ែត្រវាស់ (3m)     | 1     |        |
| 8   | USB HUB             | 1     |        |
| 9   | External Hard Drive | 1     |        |
| 10  | ធុតសំអាតតាមវ៉ា      | 1     |        |
| 11  | ជើងបណ្ណខ្សែសព្ទ     | 1     |        |
| 12  | ឡូក្លីង             | 1     |        |
| 13  | តង់តូច              | 1     |        |
| 14  | តង់ធំ               | 1     |        |
| 15  | តុនិងកៅស៊ូ          | 1     |        |

14

ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

- ❖ ការណែនាំអំពីផែនការហោះហើរសម្រាប់ អ៊ីប៊ី ជីអូ (ត)៖
  - កម្មវិធី អ៊ីម៉ូសិន ជាកម្មវិធីដែលត្រូវបានរចនាឡើង៖
    - បង្កើតផែនការហោះហើរ
    - ការគ្រប់គ្រងការហោះហើរ
    - ការត្រួតពិនិត្យកំឡុងពេលហោះហើរ
    - ការដាស់តឿនផ្សេងៗកំឡុងពេលហោះហើរ
    - ពិសេសកម្មវិធីនេះ អាចដំណើរការរួចចេញពីប្លង់
    - នឹងអាចប្រើប្រាស់សម្រាប់ការហោះហើរសាកល្បង។

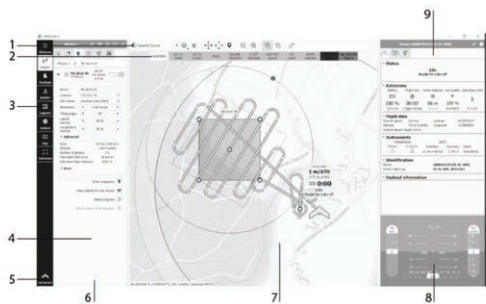


រូបភាព ការបង្កើតផែនការហោះហើរសាកល្បង

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ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

- ❖ ការណែនាំអំពីផែនការហោះហើរសម្រាប់ អ៊ីប៊ី ជីអូ (ត)៖

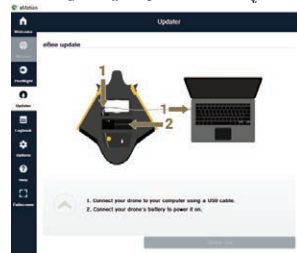


1. រោងឧបករណ៍
2. បោះត្រប់គ្រង
3. ផ្ទាំងមុខងារ
4. ផ្ទាំងបេសកកម្មខាងឆ្វេង
5. ប៉ូតុងភ្ជាប់
6. ការផ្ទេរដំណឹង
7. កន្លែងមើលចំបង
8. កន្លែងបញ្ជាក់កំណត់
9. ផ្ទាំងព័ត៌មានពីជ្រួនខាងស្តាំ

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ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

- ❖ ការណែនាំអំពីផែនការហោះហើរសម្រាប់ អ៊ីប៊ី ជីអូ (ត)៖
  - កម្មវិធី អ៊ីម៉ូសិន (ត)៖
    - ការធ្វើបច្ចុប្បន្នសេរី ត្រូវធ្វើចាំបាច់សម្រាប់កំលុងផ្លូវដែលទើបដំឡើងកម្មវិធី អ៊ីម៉ូសិន ដើម្បីអោយកម្មវិធីរបស់កំលុងទំរង់និងជ្រួនស្ថិតនៅសេរីតែមួយ។
    - ដើម្បីធ្វើបច្ចុប្បន្នភាព៖ យកខ្សែ USB ភ្ជាប់ជាមួយជ្រួន ភ្ជាប់ថ្ម (សូមកុំដាក់កង្វា) ហើយបើកកម្មវិធី អ៊ីម៉ូសិន រួចចុច Updater បន្ទាប់មកភ្ជាប់ខ្សែ USB ទៅនឹងកំលុងទំរង់។ ចុច Update Now ដើម្បីធ្វើ បច្ចុប្បន្នភាព។



រូបភាព ផ្ទាំងសម្រាប់ធ្វើបច្ចុប្បន្នភាព



រូបភាព ជ្រួនកំពុងដំឡើងការបច្ចុប្បន្នភាព

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ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

❖ ការណែនាំអំពីផែនការហោះហើរសម្រាប់ អ៊ីប៊ី ជីអូ (ត)៖

- ការបញ្ចូលថ្មដោយប្រើឆ្នាំងសាកឆ្នាំង
  - ដើម្បីបញ្ចូលថ្មជ្រួនអ្នកត្រូវមាន៖ ឡឆ្នាំងសាក ឆ្នាំងសាកថ្ម និងថ្ម eBee Geo។
  - ដំបូងត្រូវភ្ជាប់ខ្សែឆ្នាំងសាកទៅឆ្នាំងសាក រួចភ្ជាប់ជាមួយថ្ម រួចជ្រើសយក eBee X
  - ចុចប៊ូតុង Previous ដើម្បីថយក្រោយឬចុច Next ដើម្បីទៅមុខនិងចុច Enter ដើម្បីយល់ព្រម។
  - ជ្រើសយកការបញ្ចូល សម្រាប់ដឹងជំពូល ការហោះហើរ ឬរក្សាទុក ហើយចុច Enter រហូតទាល់តែចេញការត្រួតពិនិត្យថ្ម រួចចុចវាម្តងទៀតដើម្បីបញ្ចូល។
  - កុំឡង់ពេលសាកថ្ម ឬពេលបន្លយថ្ម សូមកុំផ្តាច់ ចន្លោះអាយស៊ីនប្រោះវាអាចបណ្តាលអោយមានបញ្ហាចំពោះថ្ម។ ការដាស់តឿនបងបង្ហាញលើអេក្រង់នៅពេលសាកថ្មត្រូវបានបញ្ចប់ ហើយថ្មដែលបានសាករួចហើយមិនអាចទុកបានយូរទេ។



រូបភាព សម្ភារៈសម្រាប់សាកថ្មជ្រួន

១០

ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

❖ ការរៀបចំទីតាំងហោះហើរ៖

- ទីតាំងហោះហើរ គួរតែស្ថិតនៅក្នុងកន្លែងដែលមិនមានការបាំងពីដើមឈើធំៗ អគ្គីសនី ផ្ទះ ឬខ្សែភ្លើង
- ដើម្បីដំឡើងទីតាំងហោះហើរ៖
  - ដំឡើងតង់ធំសម្រាប់ការការពារម្តៅ និងគ្រឿងអុជចិត្តរបស់អ្នក
  - ដំឡើងតង់កៅស៊ូហើយបែរមុខទៅទិសខាងជើងដើម្បីងាយស្រួលក្នុងការហោះហើរ
  - ប្រើប្រាស់ GeoBase (នៅពេលការហោះហើរតម្រូវប្រើ RTK) ដោយដាក់នៅលើទីតាំងដែលបានកំណត់និយាមការ វាស់កម្ពស់របស់ Base និងចុចបើក
  - ដំឡើងម៉ូឌុលទំនាក់ទំនងជាមួយជើងបញ្ចូលទូរសព្ទ និងបែរអង់តែននោះ ១២០ ទៅ ១៦០ ដីក្រៅទៅរកទីតាំងដែលជ្រួននឹងត្រៀមហោះហើរ រួចភ្ជាប់ម៉ូឌុលទៅកំលាំង
  - ដាក់តង់សម្រាប់ចុះចតនៅទីតាំងសមរម្យក្នុងទីវាលចុះចត
  - ភ្ជាប់ជ្រួនទៅនឹងស្ថាប័នរបស់វា និងភ្ជាប់កង្វាជាមួយម៉ូឌុលដោយរុំដោយកៅស៊ូចំនួនបី
  - ដាក់ជ្រួននៅលើតង់ចុះចត និងបែរវាបញ្ជាសម្រាប់ខ្យល់
  - ចុចបើកកំលាំង បើកកម្មវិធី អ៊ីម៉ូសិន និងភ្ជាប់ជ្រួនទៅជ្រួន
  - បង្កើតផែនការហោះហើរ (eg. ST\_Date\_XXX) ប្រសិនបើធ្លាប់បង្កើតរួចហើយទាញវាមកវិញ
  - ចុច ភ្ជាប់ជ្រួន

២០

ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

❖ ការរៀបចំទីតាំងហោះហើរ៖



២១

ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

❖ ការរៀបចំទីតាំងហោះហើរ៖



២២

ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

❖ ការរៀបចំទីតាំងហោះហើរ៖



២៣

ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

❖ ការរៀបចំទីតាំងហោះហើរ (ត)៖

- ដើម្បីដំឡើងទីតាំងហោះហើរ (ត)៖
  - (ប្រសិនបើតម្រូវការប្រើ RTK) ចុចភ្ជាប់ GeoBase ដោយ Bluetooth លេខកូដ 1234 ជ្រើសរើស RTK និងបង្កើតឈ្មោះទីតាំងដោយបញ្ចូលព័ត៌មានទីតាំងនិយាមការនិងបញ្ចូលកម្ពស់ Base។ ចុច Open base datastream និងចុច OK
  - ប្រសិនបើការហោះហើរបែបអ្នកមិនតម្រូវទីតាំងនិយាមការដាក់លាក់ (រំលងចំនុចទី១១)។ នៅក្នុងកម្មវិធីអ៊ីម៉ូសិន ជ្រើសរើស RTK ត្រង់ RTK Source ជ្រើសរើស Unknown Point រួចចុច Open base datastream និងចុច OK
  - ការបង្កើតផែនការហោះហើរក្នុងកម្មវិធី eMotion។ កំណត់ផែនការកំណត់សម្រាប់ការហោះហើរ កំណត់អតិបរមា និងកំណត់ផែនការកំណត់អតិបរមា។ កំណត់ទីតាំងហោះហើរ ដោយគ្រាន់តែចុច Place working area រួចចុចនៅលើទីតាំងគោលដៅ។ រួចកំណត់ទីតាំងចុះចតនិងហោះហើរ កុំភ្លេចចុចពាក្យ Centres ដើម្បីកំណត់ទីតាំងដែលវាស្ថិតនៅ ហើយការចុះចតគួរតែជ្រើសរើស Linear Landing។ នៅក្នុងផែនការហោះហើរ ចុច add mission block ជ្រើសរើសប្រភេទការហោះហើរ។ កំណត់កម្រិតភាពច្បាស់នៃប្រភេទ និងកម្រិតត្រួតស៊ីគ្នា នៃរូបភាពដែលថតដោយជ្រួន
  - ដំឡើងតង់តូចប្រសិនបើអាកាសធាតុប្រែប្រួលលឿន
  - គួរតែមានម៉ាស៊ីនភ្លើងចល័តដើម្បីធានា ការហោះហើរមិនមានបញ្ហា
  - ដាក់ឧបករណ៍តាមដានទៅក្នុងជ្រួន។

២៤

ការណែនាំអំពីការរៀបចំការហោះហើររៀងរាល់ អ៊ីប៊ី ជីអូ (ត)

- ❖ ការរៀបចំទីតាំងហោះហើរ (ត)៖
  - ការហោះហើរនិងការចុះចត៖
    - ត្រួតពិនិត្យមើល ថ្នាំកំពុងរៀន ជីអូប៊ីស អាកាសធាតុ ទិសខ្យល់ និងកំណត់ផែនការហោះហើរ
    - ប្រសិនបើផែនការមិនទាន់កំណត់នោះរៀននិងហោះរៀងរាល់ទីតាំងចុះចត
    - ពិនិត្យមើល Pilot Probe (បំពង់វាស់ល្បឿនខ្យល់) ប្រសិនបើឃើញពណ៌បៃតងមានន័យថាប្រព័ន្ធក្នុងការហោះហើរ
    - ត្រូវចាំថាការហោះហើរនិងការចុះចតត្រូវតែបញ្ជ្រាសទិសខ្យល់ និងកុំត្រូវបើកគំរូការម៉ា
    - ចាប់កាន់រៀងរាល់ អង្រួនទៅមុខទៅក្រោយបីដង រង់ចាំរហូតដល់ពន្លឺពណ៌បៃតងបញ្ចេញ បែររៀងរាល់ទៅមុខ ៤៥ដឺក្រេ រួចចុះឡើងលើថ្នមៗ (អង្រួនបីដងដើម្បី ដំណើរការ ប្រសិនបើមិនទាន់រៀបរយអង្រួនបីដងទៀតដើម្បីបញ្ចប់)
    - ចំណែកនៃការចុះចត រៀងរាល់ដងចុះចតដោយខ្លួនឯងនៅពេលវាបញ្ចប់បេសកកម្មរបស់វា តែអ្នកអាចចុះ Go Home ដើម្បីត្រឡប់មកទីតាំងផ្ទះវិញ និងចុះ Go Land ដើម្បីត្រឡប់មកទីតាំងផ្ទះហើយចុះចត។
    - ពិនិត្យមើលគ្រប់រូបសម្រាប់រៀងរាល់ឡើងដើម្បីរកកន្លែងដែលមានបញ្ហា។

ការណែនាំអំពីការរៀបចំការហោះហើររៀងរាល់ អ៊ីប៊ី ជីអូ (ត)

- ❖ ការរៀបចំទីតាំងហោះហើរ (ត)៖
  - ការដំណើរការទិន្នន័យបន្ទាប់ពីការហោះហើរ៖
    - ទាញយកទិន្នន័យពីអង្គចងចាំទុកក្នុងកំពូល ឬ External Hard Drive
    - ចាប់ផ្តើមដំណើរការទិន្នន័យដំបូងនៅក្នុង Post-Flight៖ ជ្រើសរើសថ្ងៃខែនៃរូបភាព ដាក់ឈ្មោះផែនការហោះហើរ រួចដាក់វានៅក្នុងទីតាំងដែលអ្នកចង់រក្សាទុក។ ចុចពាក្យ Next នៅពេលដែលអ្នករើសជ្រើសរើស ព័ត៌មានពីការថតរូបរួចរាល់ (Flight log) ចុច Next និងជ្រើសរើសលទ្ធផលដែលអ្នកចង់យកវាទៅដំណើរបន្ទាប់ទៀតជាមួយកម្មវិធីផ្សេងៗ ដូចជា៖ PIX4D ឬ Agisoft Metashape រួចចុច Next និងចុច Finish។



រូបភាព External Hard Drive



រូបភាព ផ្ទាំងដំណើរការទិន្នន័យដំបូង

ការណែនាំអំពីការរៀបចំការហោះហើររៀងរាល់ អ៊ីប៊ី ជីអូ (ត)

- ❖ សុវត្ថិភាពនិងការប្រុងប្រយ័ត្ន៖
  - រក្សាកង្វាបានស្អាត
  - បើករៀងរាល់ពេលកាន់វាឡើង
  - កុំហោះហើរដោយមិនមានការយល់ព្រមពីការម៉ា senseFly
  - កុំហោះហើរដោយមិនមានដាក់ថ្មប្រព័ន្ធបើកគំរូការម៉ា
  - កុំហោះហើរជាមួយរៀងរាល់ដល់ខូច
  - កុំហោះហើរជាមួយឧបករណ៍ខូចខាតផ្នែកណាមួយ
  - ប្រុងប្រយ័ត្នខ្ពស់នៅពេលហោះហើរនៅជិតមនុស្សឬសត្វ
  - ប្រាកដថាកង្វាគឺជាប្រព័ន្ធគ្រឹមត្រូវ និងស្ថិតក្នុងស្ថានភាពល្អណាស់
  - បើកសំឡេងកំពូលទំរង់អោយខ្ពស់ ដូចនេះអ្នកអាចលឺការដាស់តឿន
  - ត្រូវចៀសវាងស្ថានភាពប្រព័ន្ធគ្រឹមត្រូវជាមួយ Servo
  - ដើម្បីបញ្ជ្រាសកុំអោយក្តៅពេក ចាប់ផ្តើមការហោះហើរអោយបានឆាប់តាមដែលអាចធ្វើទៅបាន

ការណែនាំអំពីការរៀបចំការហោះហើររៀងរាល់ អ៊ីប៊ី ជីអូ (ត)

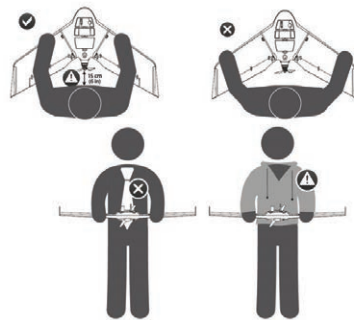
- ❖ ការណែនាំអំពីការប្រតិបត្តិការ៖
  - ប្រើតែថ្មដែលមានការយល់ព្រមពី senseFly
  - ប្រើតែម៉ូឌុលដែលមានការយល់ព្រមពី senseFly
  - ចុះចតនៅលើដីបស្មើជានិច្ច
  - ដឹងពីរបៀប និងរូបចលនាក្នុងការហោះហើររួចចុះចតប្រសិនបើមានអ្វីចាំបាច់
  - លុះត្រាតែមានការអនុញ្ញាតិ ១ ខាហ្វណ៍ការអះអាងពីអង្គការដែលពាក់ព័ន្ធ៖
    - កុំហោះហើរលើមនុស្ស
    - កុំហោះហើរនៅជិតទីក្រុង
    - កុំហោះហើរនៅជិតប្រធានយន្តហោះ
    - កុំហោះហើររៀងរាល់ការមើលអោយសោះ
  - កុំហោះនៅពេលខ្យល់បក់ខ្លាំង
  - កុំហោះនៅពេលអាកាសធាតុមិនល្អ

ការណែនាំអំពីការរៀបចំការហោះហើររៀងរាល់ អ៊ីប៊ី ជីអូ (ត)

- ❖ ការណែនាំអំពីការប្រតិបត្តិការ (ត)៖
  - ចៀសវាងការប៉ះទង្គិច នៅកន្លែងស្រឡះ ហើយផ្តល់ផ្លូវសម្រាប់យន្តហោះដទៃទៀត
  - ចៀសវាងហោះហើរនៅកន្លែងដែលកក
  - ហោះហើរដោយថ្មរបស់រៀងរាល់ពេញជានិច្ច
  - ចុះចតអោយបានល្អមុនពេលអស់ថ្ម
  - កំណត់ទីតាំងសិក្សាអោយបានត្រឹមត្រូវ
  - ហោះហើរដោយភ្ជាប់ជាមួយកម្មវិធី eMotion ជានិច្ច
  - ត្រួតពិនិត្យថ្នាំកំពុងរៀនមានគ្រប់គ្រាន់សម្រាប់ហោះហើរ
  - កុំប្រើ power saving ពេលហោះហើរ
  - បើកកម្មវិធីមិនពាក់ព័ន្ធនៅលើកំពូលអ្នក
  - កុំទុកថ្មដែលបានភ្ជាប់ជាមួយរៀងរាល់សម្រាប់ការហោះហើរបន្ថែមនៅពេលដែលវានៅលើដី
  - ប្រសិនបើកន្លែងចុះចតមានកំពស់ខុសពីកន្លែងហោះហើរ អ្នកត្រូវរកគម្រូវកំពស់
  - ប្រសិនបើអាកាសធាតុកន្លែងចុះចតដែលគ្មានឧបសគ្គ ក្នុងវិធីសាស្ត្រចុះចតនីមួយៗ (ឆ្ងាយខុសពីទីតាំងចុះចត) ប្រសិនបើការចុះចតមានត្រូវប្រើចុះចតហ្នឹង
  - ប្រសិនបើអាកាសធាតុចុះចតនៅលើទីជម្រាល កំពូល ឬតែមួយ។

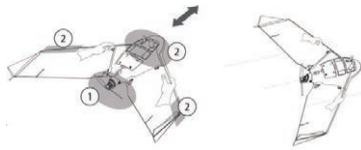
ការណែនាំអំពីការរៀបចំការហោះហើររៀងរាល់ អ៊ីប៊ី ជីអូ (ត)

- ❖ ការណែនាំអំពីការប្រតិបត្តិការ (ត)៖



ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

❖ ការណែនាំអំពីការប្រតិបត្តិការ (ត)៖



1. តំបន់គ្រោះថ្នាក់
2. កុំកាន់តំបន់នេះ



ទិសដឹក



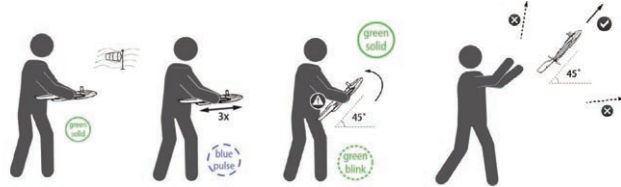
មិនមែនទិសដឹក

ពន្លឺ LED: ពណ៌បៃតងចាស់ → ពន្លឺ LED: ពណ៌ខៀវ  
អង្រួនជ្រួនបីដងពីមុខទៅក្រោម មុខទៅចាប់ផ្តើមវិលរឿងនិង LED បញ្ចេញពណ៌បៃតង។

31

ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

❖ ការណែនាំអំពីការប្រតិបត្តិការ (ត)៖



ជាគំរូនៃ ឬច្បាស់ល្អ

អង្រួនបីដង ដំណើរការ  
អង្រួនបីដងរៀបចំ បញ្ចប់

ពន្លឺពណ៌បៃតង

បែរជ្រួន ៤៥ដឺក្រេ

32

ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

❖ ការណែនាំអំពីការប្រតិបត្តិការ (ត)៖

Take-Off Do's

Push towards the sky at 45°



Take-Off Don't's

Vertical throw at too steep angle



33

ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

❖ ការណែនាំអំពីការប្រតិបត្តិការ (ត)៖



34

ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

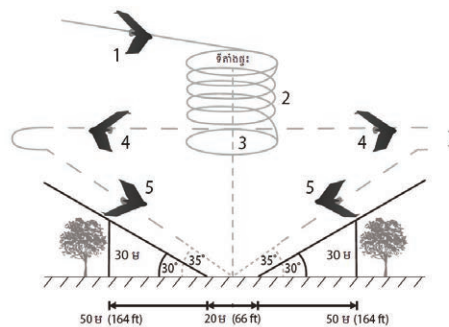
❖ ការណែនាំអំពីការប្រតិបត្តិការ (ត)៖



35

ការណែនាំអំពីការរៀបចំការហោះហើរជ្រួន អ៊ីប៊ី ជីអូ (ត)

❖ ការណែនាំអំពីការប្រតិបត្តិការ (ត)៖



36

ការហោះហើរសាកល្បងនៅក្នុងកម្មវិធី អ៊ីម៉ូសិន



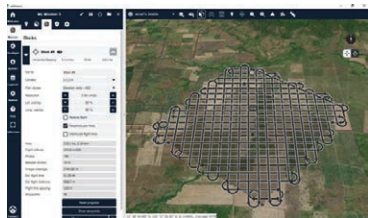
❖ បង្កើតទីតាំងហោះហើរនៅក្នុង Google Earth Pro

Coordinates

Latitude: 13 ° 38 ' 08.701 " N

Longitude: 103 ° 58 ' 26.552 " E

Centre map on this coordinates



❖ បញ្ចូលទីតាំងកូអរដោនេដើម្បីបង្កើតផែនការហោះហើរ



## 添付資料 7: 衛星画像処理判読研修資料





គម្រោងអភិវឌ្ឍន៍សមត្ថភាពក្នុងការគ្រប់គ្រងធនធានធម្មជាតិ  
ប្រកបដោយនិរន្តរភាពនៅថ្នាក់ជាតិ និងថ្នាក់ក្រោមជាតិ  
(SNRM)

សិក្ខាសាលាស្តីពី ៖ ការដំណើរការរូបភាពផ្កាយរណប និងការហោះហើរជ្រូន/  
Training of Satellite Image Processing and Interpretation

1

មាតិកា/Contents of Training

- ❑ ស្វែងយល់អំពីសេប៉ាល់/Overview of SEPAL
- ❑ ប្រភេទផ្កាយរណប/Type of Satellite Imagery
- ❑ ការបង្កើតគណនី/Creating User Accounts
  - ការបង្កើតគណនីហ្គូហ្គលអែសអ៊ិនជីន/Creating Google Earth Engine Account
  - ការបង្កើតគណនីផ្លាស់ប្តូរ/Creating NICFI Planet Account
  - ការបង្កើតគណនីសេប៉ាល់/Creating SEPAL Account
  - ការស្នើសុំទំហំផ្ទុករបស់គណនី/Requesting SEPAL Storage
- ❑ ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images
- ❑ ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/  
Land Cover Change Analysis using Satellite Data
- ❑ ការបញ្ចេញទិន្នន័យជាផែនទី/Map Export
- ❑ ការអនុវត្តន៍ការដំណើរការរូបភាពជ្រូន/Practice Drone Image Processing

2

ស្វែងយល់អំពីសេប៉ាល់/Overview of SEPAL

- សេប៉ាល់ជាប្រព័ន្ធគ្រប់គ្រងទិន្នន័យសេរីស្ថានភាពដី (SEPAL: System for Earth Observation Data Access, Processing and Analysis for Land Monitoring)
- វាសំដៅទៅលើគម្រោងមួយដែលអនុញ្ញាតអោយអ្នកប្រើប្រាស់អាចប្រើប្រាស់ទិន្នន័យផ្កាយរណប និងអ្នកប្រើប្រាស់ទាំងអស់អាចស្វែងយល់ពីបម្រែបម្រួលនៃគម្របដីតាមរយៈការប្រើប្រាស់ទិន្នន័យផ្កាយរណប
- គម្រោងសេប៉ាល់គឺជាគម្រោងដែលរៀបចំឡើងដោយអង្គការស្បៀងអាហារពិភពលោក (FAO)

ប្រភព៖ (Sepal, 2023)

SEPAL

- SEPAL: System for Earth Observation Data Access, Processing and Analysis for Land Monitoring
- It is an open source project allow users to understand dynamic of land cover changes by accessing to satellite data.
- SEPAL is founded by FAO.

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ស្វែងយល់អំពីសេប៉ាល់/ Overview of SEPAL (បន្ត)

- កន្លែងមកសេប៉ាល់ត្រូវបានប្រើប្រាស់ដូចជា/SEPAL Application៖



Forest and Land Monitoring for Climate Action



Developing an Innovative Peatlands Monitoring System



Integration of SEPAL into Uganda's National Forest Monitoring System

ប្រភព៖ (FAO, 2023)

4

ស្វែងយល់អំពីសេប៉ាល់/ Overview of SEPAL (បន្ត)

- មុខងារមួយចំនួនដែលអាចប្រើប្រាស់បាន/SEPAL Function៖
  - បង្កើនរូបភាពផ្កាយរណប/Mosaic Satellite Images
  - បង្កើតទិន្នន័យសេរីពេលវេលា/Time Series
  - បង្កើតទិន្នន័យបម្រែបម្រួល/Changes
  - បង្កើតទិន្នន័យជាសំឡេង/Alert



ប្រភព៖ (FAO, 2018)

5

ស្វែងយល់អំពីសេប៉ាល់/ Overview of SEPAL (បន្ត)

- ផ្កាយរណបដែលអាចប្រើប្រាស់បាន/Accessible Satellite Data៖
  - លេនីសាត/Landsat
  - ផ្លាស់ប្តូរ/Planet
  - សេនីទីណល/Sentinel-2

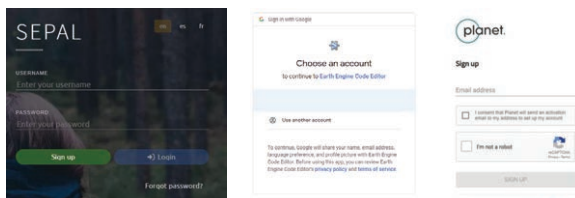


ប្រភព៖ (FAO, 2018)

6

## ស្វែងយល់អំពីសេប៉ាល់/ Overview of SEPAL (បន្ត)

- ដើម្បីអាចទាញយកទិន្នន័យបានអ្នកប្រើប្រាស់ត្រូវ/To access the data user requires:
  - ចុះឈ្មោះបង្កើតគណនីសេប៉ាល់/ Register SEPAL account
  - ចុះឈ្មោះបង្កើតគណនីហ្វូហ្គោលអ៊ីស/ Register GEE account
  - ចុះឈ្មោះបង្កើតគណនីផ្លានែត/ Register Planet account



ប្រភព៖ (FAO, 2018)

## ប្រភេទផ្កាយរណប/Type of Satellite Imagery

រូបភាពពីហ្វូហ្គោលអ៊ីស/  
Google Earth Image

លែនសែត/Landsat

- កម្រិតច្បាស់ ៣០ម/ Resolution 30m
- សម្រាប់បែន៖ ក្រហម បៃតង និងខៀវ/ Bands: Blue, Green, Red, NIR, SWIR

សែនទីណូល/Sentinel-2

- កម្រិតច្បាស់ ១០ម/ Resolution 10m
- សម្រាប់បែន៖ ក្រហម បៃតង និងខៀវ/ Bands: Blue, Green, Red, NIR

ផ្លានែត/Planet

- កម្រិតច្បាស់ ៥ម/ Resolution 5m
- សម្រាប់បែន៖ ក្រហម បៃតង និងខៀវ/ Bands: Blue, Green, Red, NIR

## ប្រភេទផ្កាយរណប/Type of Satellite Imagery (បន្ត)

| Sentinel-2 Bands              | Central Wavelength (nm) | Resolution (m) |
|-------------------------------|-------------------------|----------------|
| Band 1 - Coastal aerosol      | 0.443                   | 60             |
| Band 2 - Blue                 | 0.490                   | 10             |
| Band 3 - Green                | 0.560                   | 10             |
| Band 4 - Red                  | 0.665                   | 10             |
| Band 5 - Vegetation Red Edge  | 0.705                   | 20             |
| Band 6 - Vegetation Red Edge  | 0.740                   | 20             |
| Band 7 - Vegetation Red Edge  | 0.783                   | 20             |
| Band 8 - NIR                  | 0.842                   | 10             |
| Band 8A - Vegetation Red Edge | 0.865                   | 20             |
| Band 9 - Water vapour         | 0.940                   | 60             |
| Band 10 - SWIR1 - Clouds      | 1.275                   | 60             |
| Band 11 - SWIR2               | 1.610                   | 20             |
| Band 12 - SWIR3               | 2.190                   | 20             |

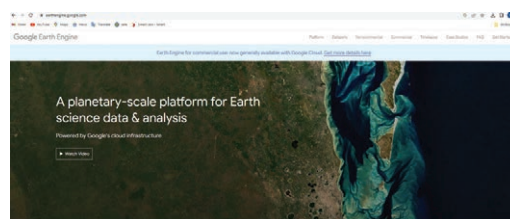
ព័ត៌មានបន្ថែមអំពីបែន/Additional Band Information

| Band                          | Wavelength (nm) | Resolution (m) |
|-------------------------------|-----------------|----------------|
| Band 1 - Coastal aerosol      | 0.443 - 0.45    | 30             |
| Band 2 - Blue                 | 0.443 - 0.45    | 30             |
| Band 3 - Green                | 0.560 - 0.57    | 30             |
| Band 4 - Red                  | 0.665 - 0.67    | 30             |
| Band 5 - Vegetation Red Edge  | 0.705 - 0.71    | 30             |
| Band 6 - Vegetation Red Edge  | 0.740 - 0.75    | 30             |
| Band 7 - Vegetation Red Edge  | 0.783 - 0.79    | 30             |
| Band 8 - NIR                  | 0.842 - 0.85    | 30             |
| Band 8A - Vegetation Red Edge | 0.865 - 0.87    | 30             |
| Band 9 - Water vapour         | 0.940 - 0.95    | 30             |
| Band 10 - SWIR1 - Clouds      | 1.275 - 1.28    | 30             |
| Band 11 - SWIR2               | 1.610 - 1.62    | 30             |
| Band 12 - SWIR3               | 2.190 - 2.20    | 30             |

| PlanetScope Band | Spectrum Region | Wavelength (nm) | Spatial Resolution |
|------------------|-----------------|-----------------|--------------------|
| Band 1           | Blue            | 440-515         | 3m                 |
| Band 2           | Green           | 555-565         | 3m                 |
| Band 3           | Red             | 640-670         | 3m                 |

## ការបង្កើតគណនី/Creating User Accounts

- ការបង្កើតគណនីហ្វូហ្គោលអ៊ីសអ៊ិនធឺណិត/Google Earth Engine Account Creating:
  - អ្នកប្រើប្រាស់ត្រូវមានគណនី ជីមែល/User requires to have Gmail account
  - សូមចូលទៅកាន់ជីមែលរបស់អ្នកសិន/You have to log in first
  - ចូលទៅកាន់/go to [earthengine.google.com](https://earthengine.google.com)

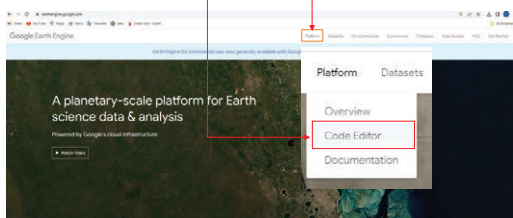


Meet Earth Engine

Google Earth Engine combines a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities. Scientists, researchers, and developers use Earth Engine to detect changes, map trends, and quantify differences on the Earth's surface. Earth

## ការបង្កើតគណនី/Creating User Accounts

- ចុចលើ/Click on : Platform
- រួចជ្រើសរើស/ Then select: Code Editor

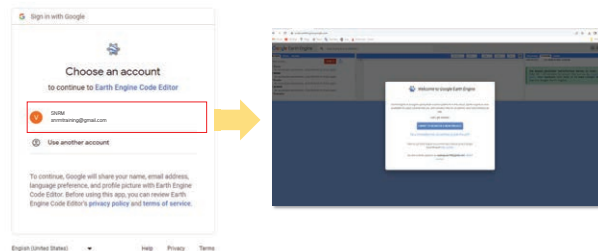


Meet Earth Engine

Google Earth Engine combines a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities. Scientists, researchers, and developers use Earth Engine to detect changes, map trends, and quantify differences on the Earth's surface. Earth

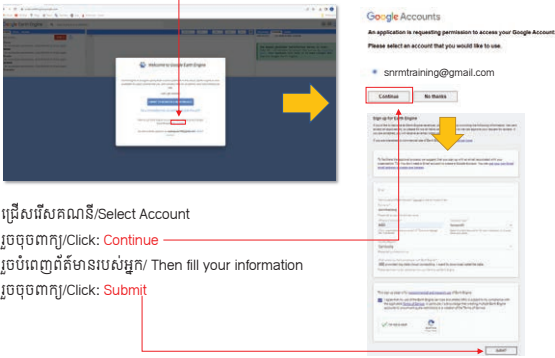
## ការបង្កើតគណនី/Creating User Accounts (បន្ត)

- ជ្រើសរើសគណនី/Select Account
- រួចជ្រើសរើសវា/ Then Click on It



## ការបង្កើតគណនី/Creating User Accounts (បន្ត)

- ជ្រើសរើស/Select : **Sign up here**

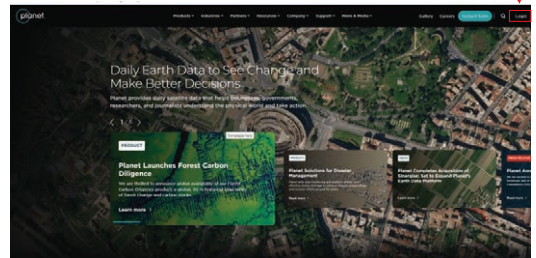


- ជ្រើសរើសគណនី/Select Account
- រួចចុចពាក្យ/Click: **Continue**
- រួចបំពេញព័ត៌មានរបស់អ្នក/ Then fill your information
- រួចចុចពាក្យ/Click: **Submit**

13

## ការបង្កើតគណនី/Creating User Accounts (បន្ត)

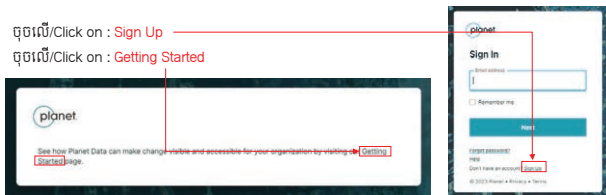
- ការបង្កើតគណនីផ្ទៃក្នុង/Planet Account Creating៖
  - អ្នកប្រើប្រាស់ត្រូវមានគណនី អ៊ីមែល/User require to have Gmail account
  - ចូលទៅកាន់ **planet.com**
  - ចុចលើ/Click on : **Login**



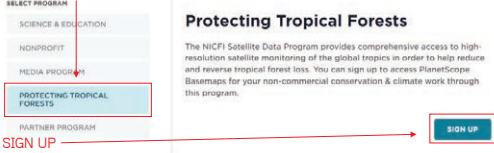
14

## ការបង្កើតគណនី/Creating User Accounts (បន្ត)

- ចុចលើ/Click on : **Sign Up**
- ចុចលើ/Click on : **Getting Started**



- រួចជ្រើសរើស/ Then select: **PROTECTING TROPICAL FORESTS**

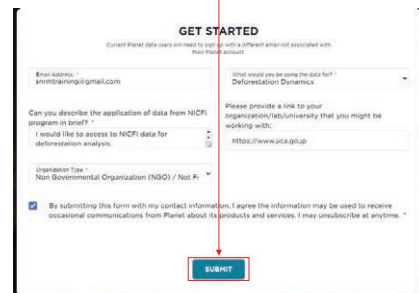


- ចុចលើ/Click on : **SIGN UP**

15

## ការបង្កើតគណនី/Creating User Accounts (បន្ត)

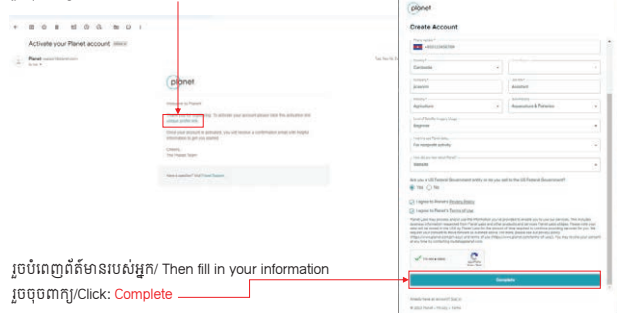
- រួចបំពេញព័ត៌មានរបស់អ្នក/ Then fill in your information
- រួចចុចពាក្យ/Click: **Submit**



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## ការបង្កើតគណនី/Creating User Accounts (បន្ត)

- បើកគណនីអ៊ីមែលរបស់អ្នក/ Open your Gmail
- រួចចុចពាក្យ/Click: **unique profile link**

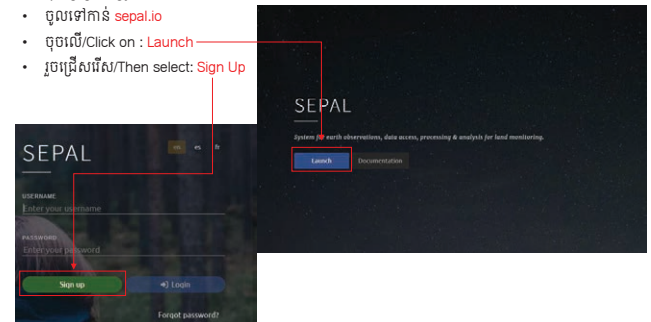


- រួចបំពេញព័ត៌មានរបស់អ្នក/ Then fill in your information
- រួចចុចពាក្យ/Click: **Complete**

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## ការបង្កើតគណនី/Creating User Accounts (បន្ត)

- ការបង្កើតគណនីសេបាល់/Creating SEPAL Account៖
  - អ្នកប្រើប្រាស់ត្រូវមានគណនី អ៊ីមែល/User requires to have Gmail account
  - ចូលទៅកាន់ **sepal.io**
  - ចុចលើ/Click on : **Launch**
  - រួចជ្រើសរើស/Then select: **Sign Up**



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## ការបង្កើតគណនី/Creating User Accounts (បន្ត)

- រួចបំពេញព័ត៌មានរបស់អ្នក/ Then fill in your information
- រួចចុចពាក្យ/Click: **Sign up**

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## ការបង្កើតគណនី/Creating User Accounts (បន្ត)

- បើកគណនីដើមរបស់អ្នក/ Open your Gmail
- រួចចុចពាក្យ/Click: **This**

- បញ្ចូលលេខសំងាត់/Enter Password
- រួចចុចពាក្យ/Click: **Set password**

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## ការបង្កើតគណនី/Creating User Accounts (បន្ត)

- រួចចុចពាក្យ/Click: **\$0/h**
- ចុចពាក្យ/Click: **Request additional resources**
- រួចបំពេញការស្នើសុំ/Fill request and Apply

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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images

- ចូលទៅកាន់ **sepal.io**
- ចុចលើ/Click on : **Launch**
- បំពេញព័ត៌មាន/ Fill information
- រួចជ្រើសរើស/Then select: **Login**

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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

- ផ្កាយរណបដែលអាចប្រើប្រាស់បានរួមមាន/Accessible Satellite Data:
  - លេនីសាត/Landsat
  - ផ្កានៃត/Planet
  - សេនទីណល/Sentinel-2



ប្រភព: (FAO, 2018)

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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

- ចុចពាក្យ/Click: **Add receipt**
- រួចជ្រើសរើស/Select: **Landsat or Sentinel-2**

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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

ផ្ទាំងសេប៉ាល់/SEPAL

- កន្លែងដំណើរការប្រតិបត្តិការ/Process
- កន្លែងផ្ទុកទិន្នន័យ/File
- កន្លែងសរសេរឈ្មោះ/Rename
- កន្លែងទាញយកទិន្នន័យ/Download
- កន្លែងកំណត់ទីតាំងទិន្នន័យ/AOI
- កន្លែងកំណត់កាលបរិច្ឆេទ/DATE
- កន្លែងកំណត់ទិន្នន័យ/SOURCE
- កន្លែងកំណត់ទិន្នន័យ/SCENES
- កន្លែងកំណត់មុខងារដំណើរការ/COMPOSITE
- កន្លែងត្រួតពិនិត្យដំណើរការ/Tasks

## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

- ចុចលើ/Click on : AOI
- ជ្រើសរើស/ Select: Select Country/Province (1)
- ជ្រើសរើស/Select: Cambodia
- រួចជ្រើសរើស/Then select: ខេត្តណាមួយ/Province

## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

- ប្រសិនបើអ្នកចង់កំណត់ទីតាំង/If you want to set buffer
- ចុចពាក្យ/Click on: Next
- ចុចពាក្យ/Click on: More
- រួចជ្រើសរើស/Then select: កាលបរិច្ឆេទ/Date
- ចុចពាក្យ/Click on: Next
- ជ្រើសរើសប្រភពទិន្នន័យ/Select Source: L9/L8 ឬ S2 ឬ L9 ឬ L8
- កំណត់ភាគរយពពក/Set Cloud Cover %

## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

- ដើម្បីទាញយក/Downloading Data#
- ចុចលើ/Click on: [Icon]
- ជ្រើសរើសប្រភព/Select bands
- កំណត់កម្រិតច្បាស់/Set Resolution
- ចុចលើ/Click on: More
- ជ្រើសរើសលេខ/Select: 100
- ចុចលើ/Click on: Retrieve

## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

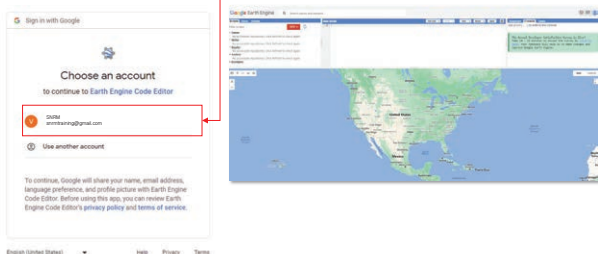
- ចុចលើ/Click on: [Icon]
- សញ្ញាត្រឹមសមាសន័យថាការដំណើរការរួចរាល់/Tick mean finished
- ចុចលើ/Click on: [Icon]
- ជ្រើសរើសទិន្នន័យ/Select data
- ចុចលើទិន្នន័យ /Click on data
- ចុចទាញយក/Click download

## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

- ការទាញយកទិន្នន័យដោយប្រើប្រាស់ទីតាំងខ្លួនឯង/Downloading data using own shapefile#
- ចូលទៅកាន់/go to [earthengine.google.com](https://earthengine.google.com)
- ចុចលើ/Click on : Platform
- រួចជ្រើសរើស/Then select: Code Editor

## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

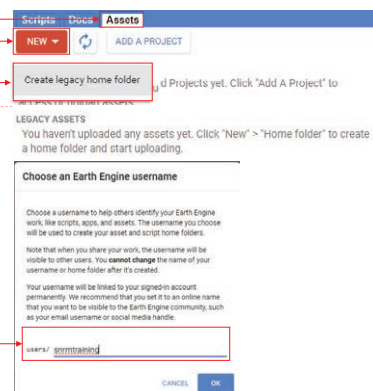
- ជ្រើសរើសគណនី/Select Account
- រួចជ្រើសរើស/ Then Click on It



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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

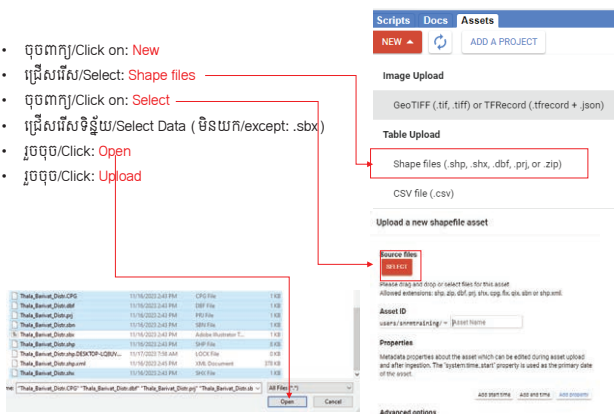
- ជ្រើសរើស/Select: Assets
- ចុចពាក្យ/Click on: New
- ជ្រើសរើស/Select: Create legacy home ...
- បំពេញឈ្មោះ/Type Name



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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

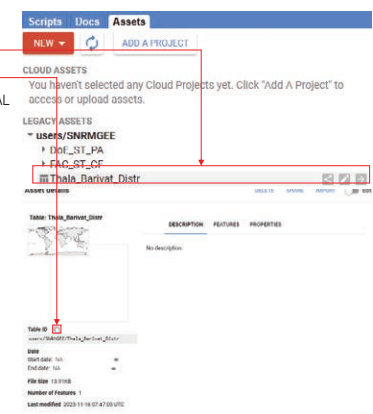
- ចុចពាក្យ/Click on: New
- ជ្រើសរើស/Select: Shape files
- ចុចពាក្យ/Click on: Select
- ជ្រើសរើសទិន្នន័យ/Select Data (មិនយក/except: .sbx)
- រួចចុច/Click: Open
- រួចចុច/Click: Upload



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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

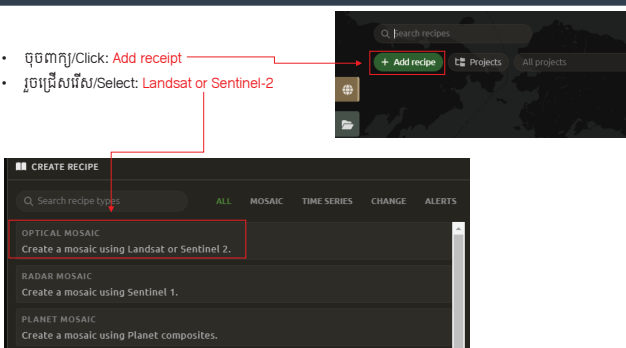
- ចុចលើទិន្នន័យ/Click data
- ចុចលើ/Click on: [Icon]
- ត្រឡប់ទៅកាន់សេប៉ាល់វិញ/Back to SEPAL



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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

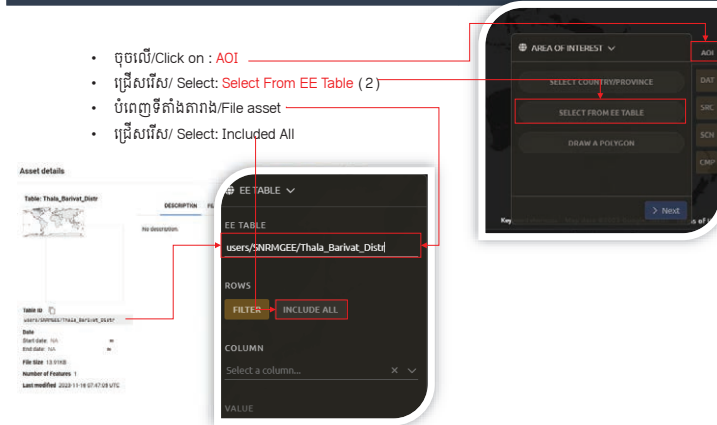
- ចុចពាក្យ/Click: Add receipt
- រួចជ្រើសរើស/Select: Landsat or Sentinel-2



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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

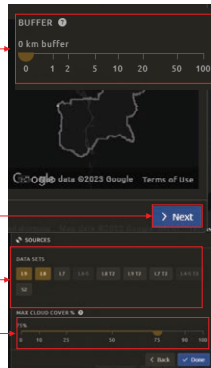
- ចុចលើ/Click on: AOI
- ជ្រើសរើស/ Select: Select From EE Table (2)
- បំពេញទីតាំងតារាង/File asset
- ជ្រើសរើស/ Select: Included All



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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

- ប្រសិនបើចង់ជ្រើសរើស/If you want buffer
- ចុចពាក្យ/Click on: **Next**
- ចុចពាក្យ/Click on: **More**
- រួចជ្រើសរើស/Then select: កាលបរិច្ឆេទ/Date
- ចុចពាក្យ/Click on: **Next**
- ជ្រើសរើសប្រភពទិន្នន័យ/Select Source: L9/L8 ឬ S2 ឬ L9 ឬ L8
- កំណត់ភាគរយពពក/Set Cloud Cover %

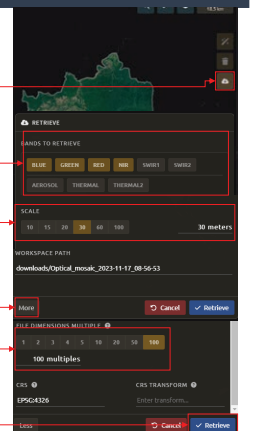


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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

- ដើម្បីទាញយក/Downloading Data:

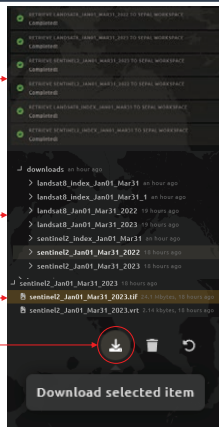
- ចុចលើ/Click on: **RETRIEVE**
- ជ្រើសរើសប្រភព/Select bands
- កំណត់កម្រិតច្បាស់/Set Resolution
- ចុចលើ/Click on: **More**
- ជ្រើសរើសលេខ/Select: **100**
- ចុចលើ/Click on: **Retrieve**



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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

- ចុចលើ/Click on: **OK**
- សង្កេតមើលមានន័យថាដំណើរការរួចរាល់/Tick mean finished
- ចុចលើ/Click on: **Download**
- ជ្រើសរើសទិន្នន័យ/Select data
- ចុចលើទិន្នន័យ /Click on data
- ចុចទាញយក/Click download



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## ការទាញយករូបភាពផ្កាយរណប/Downloading Satellite Images (បន្ត)

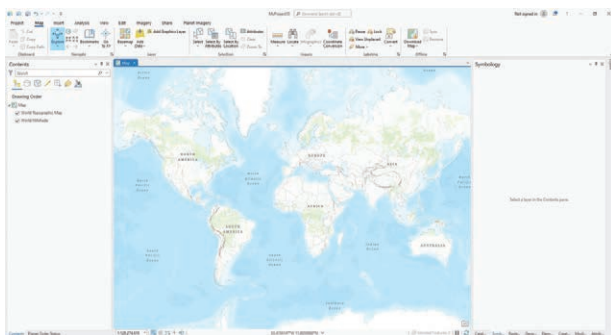
- អនុវត្ត/Practice :

- ទាញយករូបភាពផ្កាយរណបនៃស្រុកថាឡាបរីវាត/Download satellite data of Thalaborivat District:
  - លេខស្រុក និងលេខស្រុក/2/Landsat8 & Sentinel-2
  - កាលបរិច្ឆេទ/Date:
    - ថ្ងៃទី០១ ខែមករា ដល់ ថ្ងៃទី៣១ ខែមីនា ឆ្នាំ២០២២/01Jan-31Mar2022
    - និងថ្ងៃទី០១ ខែមករា ដល់ ថ្ងៃទី៣១ ខែមីនា ឆ្នាំ២០២៣/01Jan-31Mar2023
  - ប្រភព/Bands: Blue Green Red & Nir

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## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data

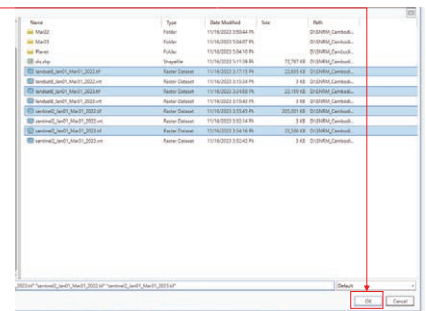
- ចុចបើកកម្មវិធី/ArcGIS Pro/Open ArcGIS Pro:



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## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data (បន្ត)

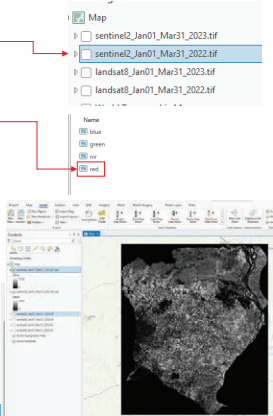
- ចុចលើ/Click on: **Map >> Add Data**
- ជ្រើសរើសទិន្នន័យផ្កាយរណប/ Select satellite data
- ចុច/Click: **OK**



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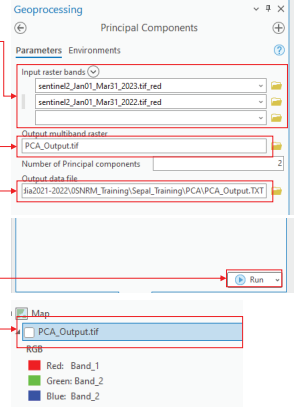
## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data ( បន្ត )

- ចុចដកសញ្ញាត្រឹម/Click untick
- ចុចលើ/Click on: Map >> Add Data
- ចុចចូលទៅក្នុងបន្ទប់សន្ទនា/Click inside band
- ចុចលើបន្ទប់/Click on Band2 ( red )
- ចុច/Click: OK
- បើបែបនេះលើផ្ទាំងមូលដ្ឋាន/Do it the same for another year
- ចុចលើ/Click on: View>> Geoprocessing>>Toolboxes
- ស្វែងរក/Find: Spatial Analyst tools
- នៅក្នុងវាមាន/Inside there is: Multivariate
- ស្វែងរក/Find: Principle Components
- ចុចលើវា/Click on it



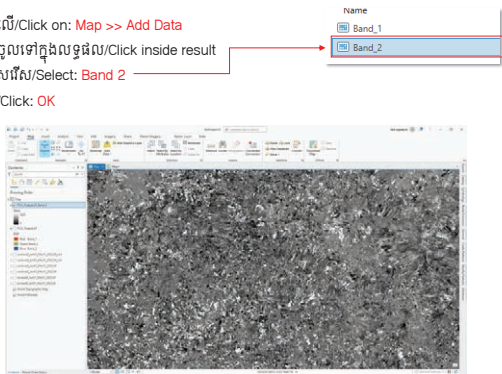
## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data ( បន្ត )

- ជ្រើសរើសទិន្នន័យ/Select data
- កំណត់ទីតាំងរក្សាទុក/Select storing location
- ចុច/Run
- ចុចដកសញ្ញាត្រឹមលើលទ្ធផល/Untick on result



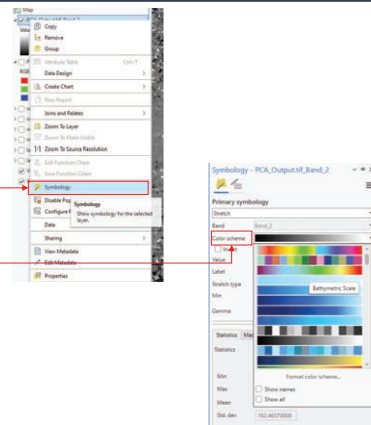
## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data ( បន្ត )

- ចុចលើ/Click on: Map >> Add Data
- ចុចចូលទៅក្នុងលទ្ធផល/Click inside result
- ជ្រើសរើស/Select: Band 2
- ចុច/Click: OK



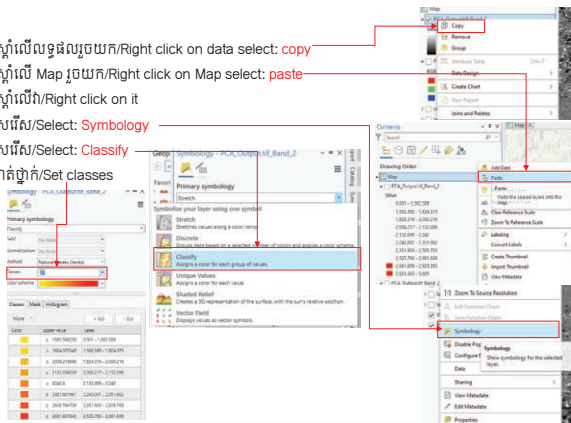
## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data ( បន្ត )

- ម៉ៅស្កូលើលទ្ធផល/Right click on data
- ជ្រើសរើស/Select: Symbology
- ជ្រើសរើសពណ៌/Select color



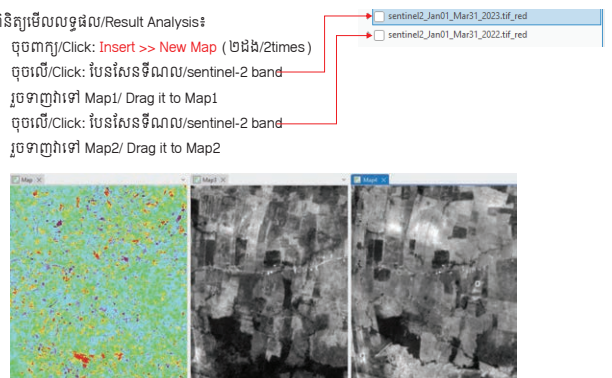
## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data ( បន្ត )

- ម៉ៅស្កូលើលទ្ធផល/Right click on data select: copy
- ម៉ៅស្កូលើ Map រួចយក/Right click on Map select: paste
- ម៉ៅស្កូលើវា/Right click on it
- ជ្រើសរើស/Select: Symbology
- ជ្រើសរើស/Select: Classify
- កំណត់ថ្នាក់/Set classes

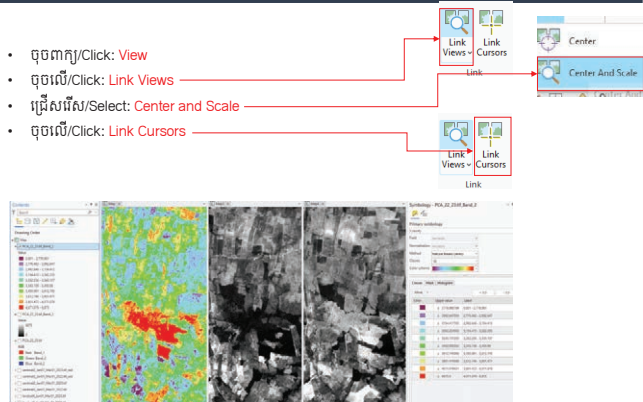


## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data ( បន្ត )

- ❖ ការពិនិត្យមើលលទ្ធផល/Result Analysis:
- ចុចកាត់/Click: Insert >> New Map ( ២ដង/2times )
- ចុចលើ/Click: បន្ទប់សន្ទនា/sentinel-2 band
- រួចទាញវាទៅ Map1/ Drag it to Map1
- ចុចលើ/Click: បន្ទប់សន្ទនា/sentinel-2 band
- រួចទាញវាទៅ Map2/ Drag it to Map2

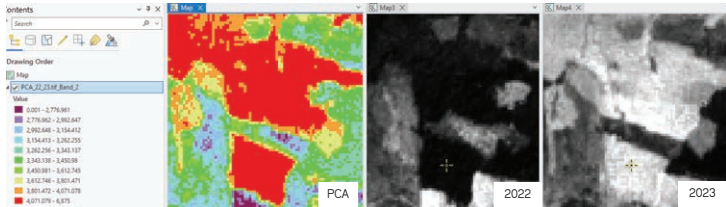


## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data ( បន្ត )



- ចុចពាក្យ/Click: **View**
- ចុចលើ/Click: **Link Views**
- ជ្រើសរើស/Select: **Center and Scale**
- ចុចលើ/Click: **Link Cursors**

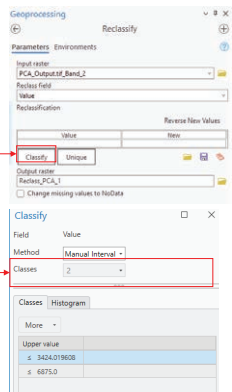
## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data ( បន្ត )



តាមការពិនិត្យលើប្រភពបានបង្ហាញថាពណ៌ក្រហម និងទង់ដែងគឺសំដៅលើការប្រែប្រួលទ្រង់ទ្រាយពីព្រៃទៅមិនមែនព្រៃ/  
PCA indicates red and orange colors represent the changes of forest to non-forest.

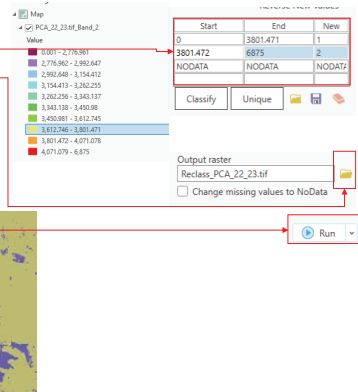
## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data ( បន្ត )

- ចុចលើ/Click on: **View>> Geoprocessing>>Toolboxes**
- រក/Find: **Spatial Analyst tools**
- នៅក្នុងវាមាន/Inside there is: **Reclass**
- រក/Find: **Reclassify**
- ចុចលើ/Click on it
- ជ្រើសរើសលទ្ធផល/Select data
- ចុចលើ/Click on: **Classify**
- កំណត់ថ្នាក់/Set classes
- ចុច/Click: **OK**



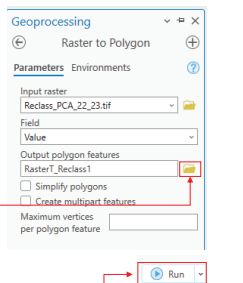
## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data ( បន្ត )

- បំពេញលេខ/Fill number
- កំណត់ទីតាំងរក្សាទុក/Select storing location
- សរសេរឈ្មោះ/Rename
- ចុចពាក្យ/Click: **Save**
- ចុចពាក្យ/Click: **Run**
- រួចបិទ/Close: **Map1 & Map2**



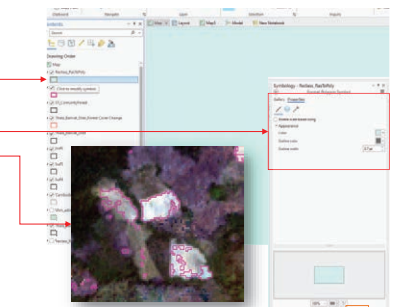
## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data ( បន្ត )

- ❖ ការស្វែងរកទីតាំងបម្រែបម្រួល/Identify changed area:
  - ចុចលើ/Click on: **View>> Geoprocessing>>Toolboxes**
  - រក/Find: **Conversion Tools**
  - នៅក្នុងវាមាន/Inside there is: **From Raster**
  - រក/Find: **Raster to Polygon**
  - ចុចលើ/Click on it
  - បញ្ជូនទិន្នន័យ/Input data
  - កំណត់ទីតាំងរក្សាទុក/Select storing location
  - សរសេរឈ្មោះ/Rename
  - ចុចពាក្យ/Click: **Save**
  - ចុចដកសញ្ញាត្រឹម/Untick
  - ចុចពាក្យ/Click: **Run**



## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data ( បន្ត )

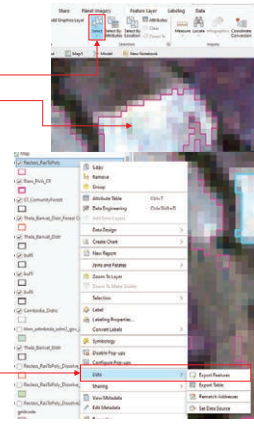
- ❖ ការស្វែងរកទីតាំងបម្រែបម្រួល/Identify changed area:
  - ចុចលើ/Click on: **Map>> Add Data>> ស្វែងរកទិន្នន័យដែលចង់សិក្សា ( site data )**
  - ចុចលើ/Click on it
  - ចុច/Click: **OK**
  - ចុចលើ/Click on it
  - ជ្រើសរើសពណ៌/Select Color
  - ចុច/Click: **Apply**
  - ពង្រីកទីតាំងដែលប្រែប្រួល /Find changed area



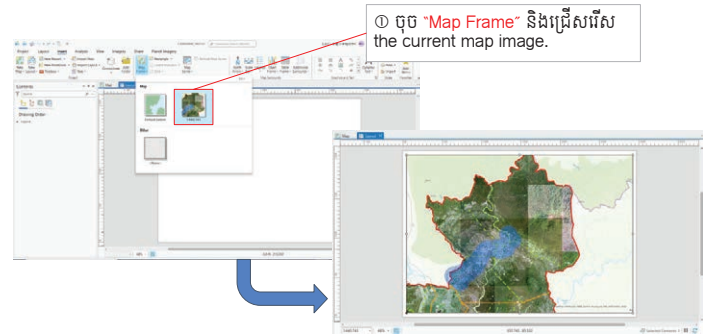
## ការប្រើប្រាស់ទិន្នន័យផ្កាយរណបក្នុងការសិក្សាពីបម្រែបម្រួលដី/ Land Cover Change Analysis using Satellite Data (បន្ត)

❖ ការស្វែងរកទីតាំងបម្រែបម្រួល/Identify changed area:

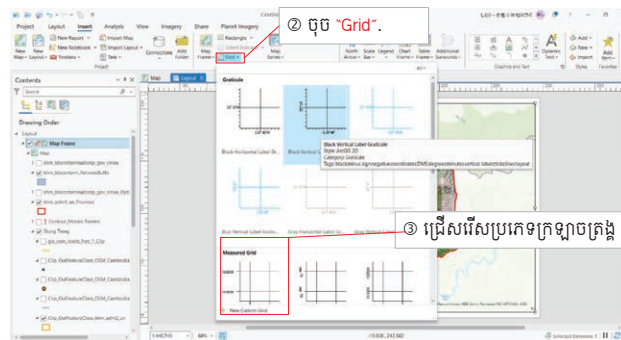
- ចុចលើ/Click on: Map>> Select
- ចុចលើទិន្នន័យដែលបានសិក្សា (click changed data)
- ចុចស្តាំលើទិន្នន័យបម្រែបម្រួល/Right click on changed data
- ជ្រើសរើស/Select: Data>> Export Feature
- (output) ចុច/Click: Browse
- ស្វែងរកកន្លែងរក្សាទុក និងដាក់ឈ្មោះវា / choose folder and rename
- ចុច/Click: OK (ពីរដង/ Twice)



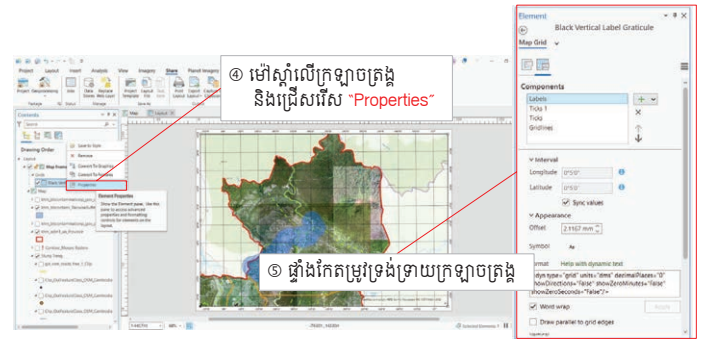
## ការបញ្ចេញទិន្នន័យជាផែនទី/Map Export



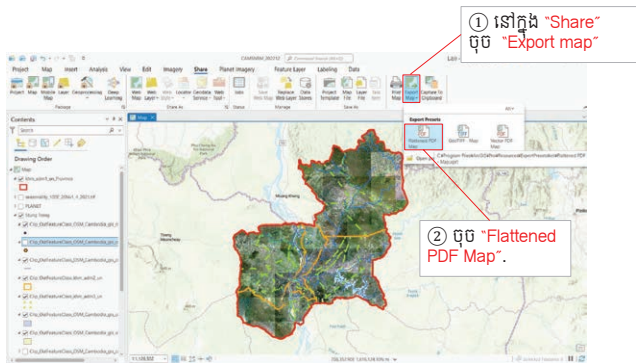
## ការបញ្ចេញទិន្នន័យជាផែនទី/Map Export (បន្ត)



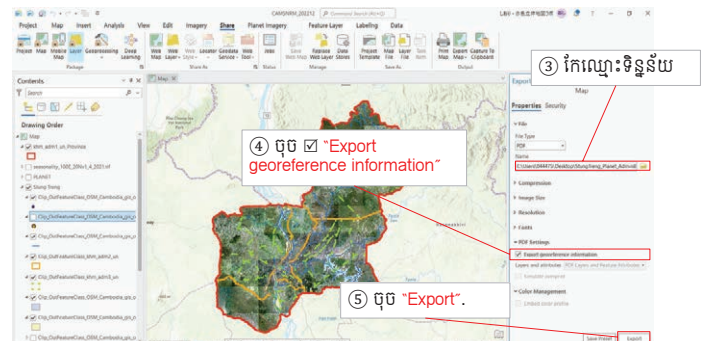
## ការបញ្ចេញទិន្នន័យជាផែនទី/Map Export (បន្ត)

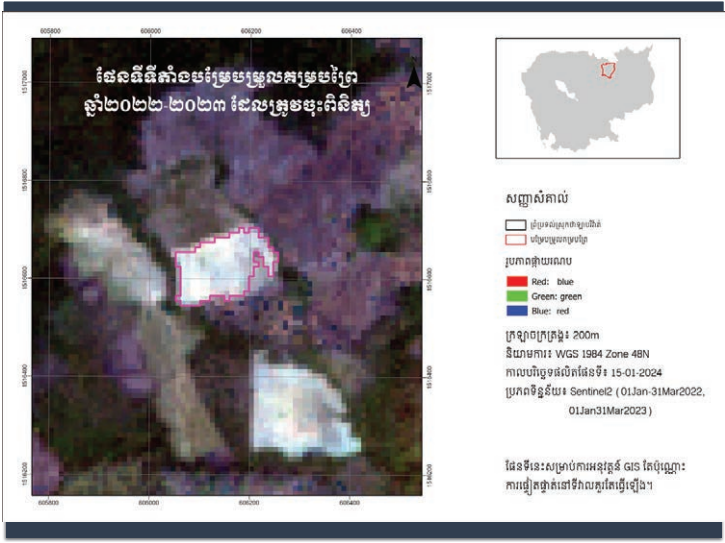


## ការបញ្ចេញទិន្នន័យជាផែនទី/Map Export (បន្ត)



## ការបញ្ចេញទិន្នន័យជាផែនទី/Map Export (បន្ត)





## ការចុះពិនិត្យផ្ទាល់នៅទីកន្លែង/ Ground Truth

- ❖ កំណត់គោលបំណងនៃការចុះទៅទីកន្លែង/Set objective៖
  - ក្នុងការសិក្សានេះយើងផ្ដោតលើពី៖
    - ប្រើប្រាស់ផ្ទៃដីដើម្បីប្រៀបធៀបទិន្នន័យពីរូបភាព
    - ផលិតផែនទីប្រៀបធៀបប្រភេទដីស្រែ និងប្រភេទដីស្រូវ



## ការអនុវត្តន៍ការងារណែនាំការប្រែប្រួលរូបភាព/Practice Drone Image Processing

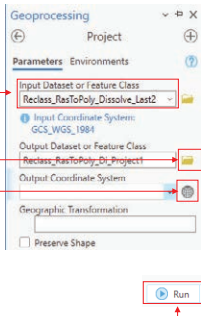
“របៀបដំណើរការទិន្នន័យរូបភាពពីទូក  
ដោយប្រើប្រាស់កម្មវិធី PIX4D  
(Pix4Dmapper)”



## ការអនុវត្តន៍ការងារណែនាំការប្រែប្រួលរូបភាព/Practice Drone Image Processing ( បន្ត )

ប្រសិនបើអ្នកចង់ដឹងទំហំ/ if you want to calculate area

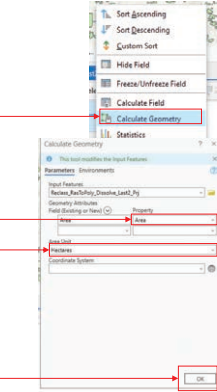
- ❖ ការស្វែងរកទំហំប្រែប្រួល/Calculate changed area ( បន្ត )៖
  - ចុចលើ/Click on: **View>> Geoprocessing>>Toolboxes**
  - ស្វែងរក/Find: **Project and Transformations**
  - នៅក្នុងវ៉ាន/Inside there is: **Raster**
  - ស្វែងរក/Find: **Project**
  - ចុចលើវ៉ាន/Click on it
  - បញ្ជូនទិន្នន័យ/Input data
  - កំណត់ទីតាំងរក្សាទុក/Select storing location
  - សរសេរឈ្មោះ/Rename
  - ចុចតាម/Click: **Save**
  - ចុចលើ/Click: **Run**
  - ចូលទៅកាន់/Go to: **Project Coordinate System>>UTM>>WGS1984 Northern Hemisphere>> WGS 1984 UTM Zone 48N**
  - ចុចលើវ៉ាន/Click on it
  - ចុច/Click: **Ok** និងចុចតាម/Click: **Run**



## ការអនុវត្តន៍ការងារណែនាំការប្រែប្រួលរូបភាព/Practice Drone Image Processing ( បន្ត )

ប្រសិនបើអ្នកចង់ដឹងទំហំ/ if you want to calculate area

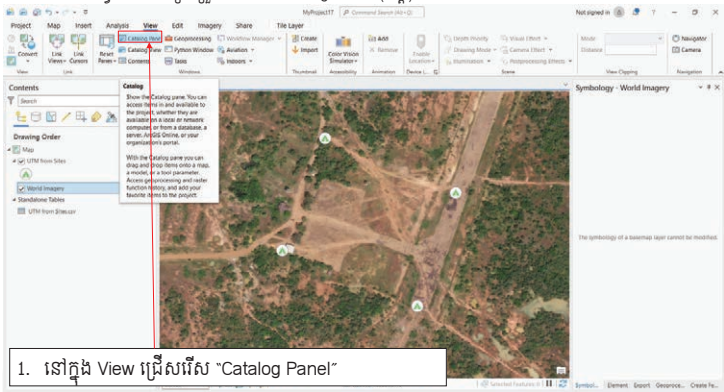
- ❖ ការស្វែងរកទំហំប្រែប្រួល/Calculate changed area ( បន្ត )៖
  - មើលស្តីលើ/Right click: **Area**
  - ជ្រើសរើស/Select: **Calculate Geometry**
  - ជ្រើសរើស/Select: **Area**
  - ជ្រើសរើស/Select: **Hectares**
  - ចុច/Click: **OK**



## ការអនុវត្តការងារណែនាំការប្រកាស/Practice Drone Image Processing (បន្ត)

ប្រសិនបើអ្នកចង់ដឹងទំហំ/If you want to calculate area

❖ ការស្វែងរកទំហំប្រែប្រួល/Calculate changed area (បន្ត)៖



## ការអនុវត្តការងារណែនាំការប្រកាស/Practice Drone Image Processing (បន្ត)

ប្រសិនបើអ្នកចង់ដឹងទំហំ/If you want to calculate area

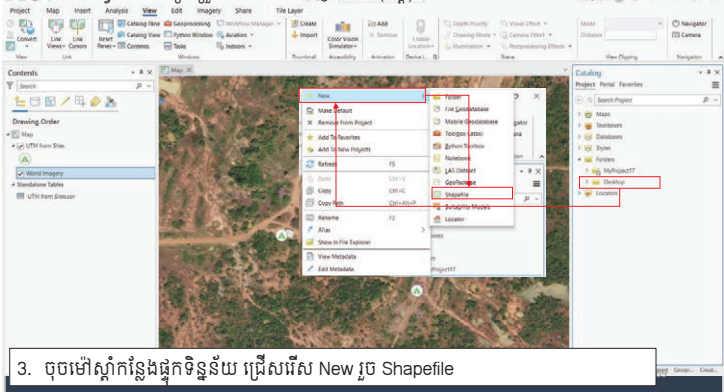
❖ ការស្វែងរកទំហំប្រែប្រួល/Calculate changed area (បន្ត)៖



## ការអនុវត្តការងារណែនាំការប្រកាស/Practice Drone Image Processing (បន្ត)

ប្រសិនបើអ្នកចង់ដឹងទំហំ/If you want to calculate area

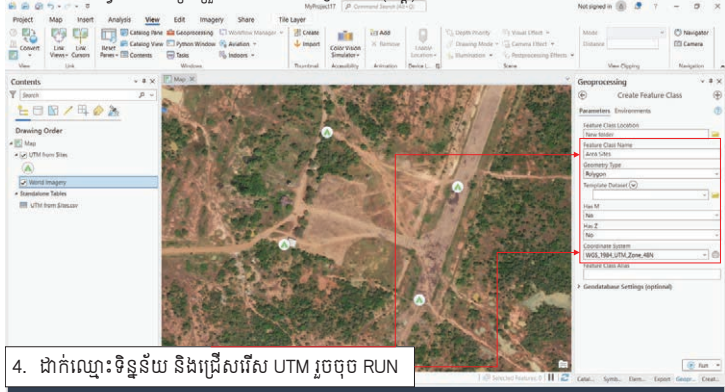
❖ ការស្វែងរកទំហំប្រែប្រួល/Calculate changed area (បន្ត)៖



## ការអនុវត្តការងារណែនាំការប្រកាស/Practice Drone Image Processing (បន្ត)

ប្រសិនបើអ្នកចង់ដឹងទំហំ/If you want to calculate area

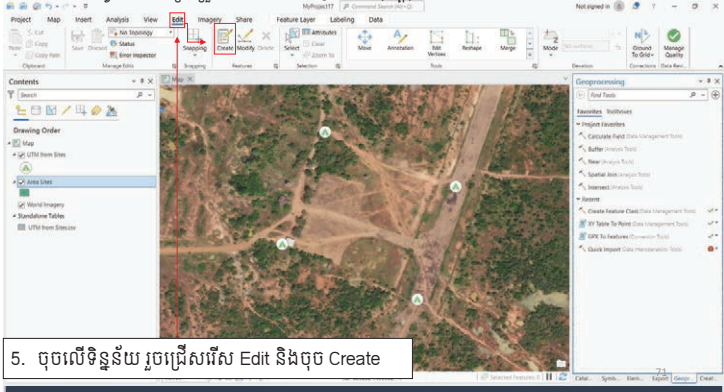
❖ ការស្វែងរកទំហំប្រែប្រួល/Calculate changed area (បន្ត)៖



## ការអនុវត្តការងារណែនាំការប្រកាស/Practice Drone Image Processing (បន្ត)

ប្រសិនបើអ្នកចង់ដឹងទំហំ/If you want to calculate area

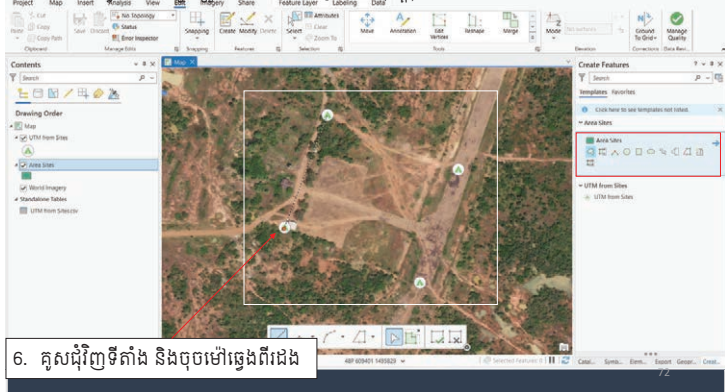
❖ ការស្វែងរកទំហំប្រែប្រួល/Calculate changed area (បន្ត)៖



## ការអនុវត្តការងារណែនាំការប្រកាស/Practice Drone Image Processing (បន្ត)

ប្រសិនបើអ្នកចង់ដឹងទំហំ/If you want to calculate area

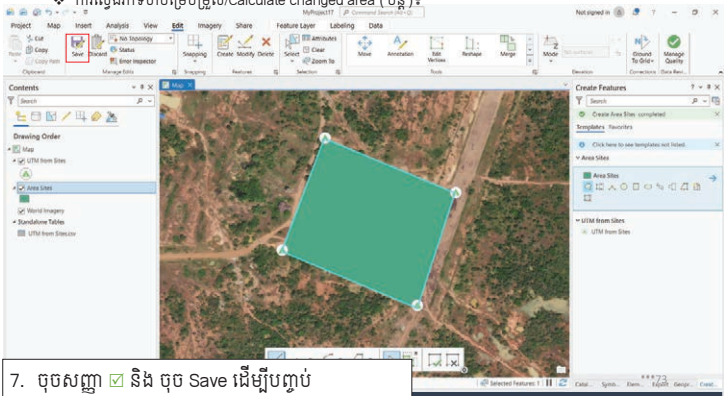
❖ ការស្វែងរកទំហំប្រែប្រួល/Calculate changed area (បន្ត)៖



## ការអនុវត្តន៍ការដំណើរការរូបភាពគ្រឿង/Practice Drone Image Processing ( បន្ត )

ប្រសិនបើអ្នកចង់ដឹងទំហំ/If you want to calculate area

❖ ការស្វែងរកទំហំប្រែប្រួល/Calculate changed area ( បន្ត ) ៖



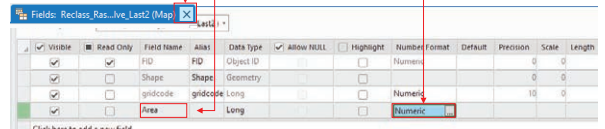
7. ចុចសញ្ញា រីឯ ចុច Save ដើម្បីបញ្ចប់

## ការអនុវត្តន៍ការដំណើរការរូបភាពគ្រឿង/Practice Drone Image Processing ( បន្ត )

ប្រសិនបើអ្នកចង់ដឹងទំហំ/If you want to calculate area

❖ ការស្វែងរកទំហំប្រែប្រួល/Calculate changed area ( បន្ត ) ៖

- មើលស្តាប់លើលក្ខណៈទូទៅ/Right click on data select: **Attribute Table**
- ចុចកាត់/Click: **Add**
- បំពេញឈ្មោះ/Fill name
- ជ្រើសរើស/Select: **Numeric**
- ចុចកាត់/Click: **Save**
- ចុចសញ្ញា/Click



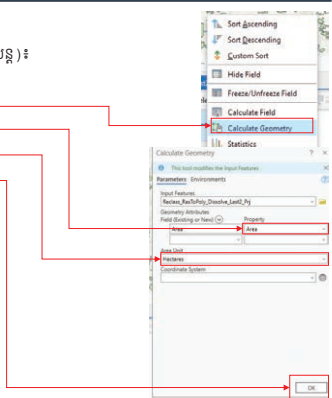
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## ការអនុវត្តន៍ការដំណើរការរូបភាពគ្រឿង/Practice Drone Image Processing ( បន្ត )

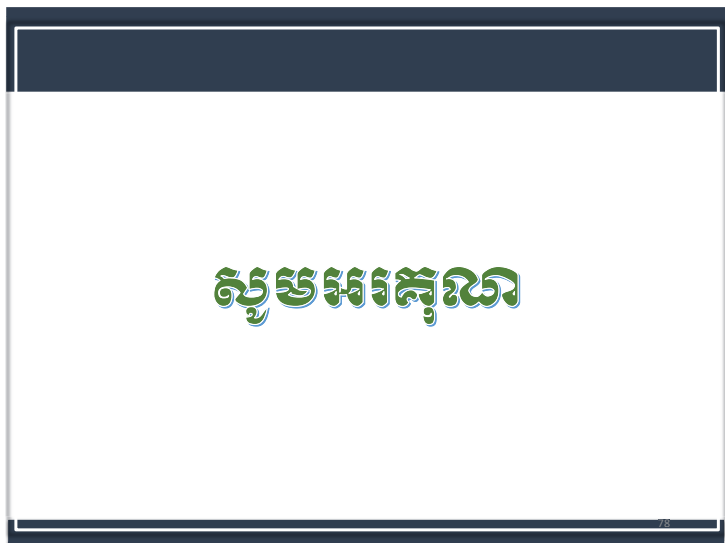
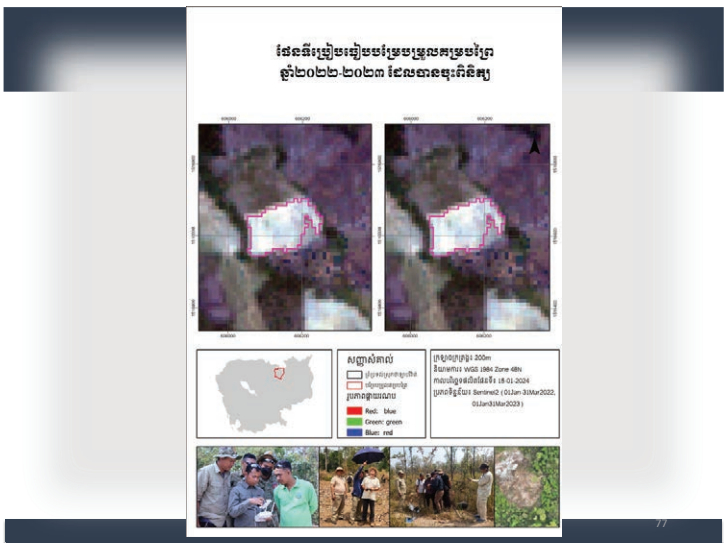
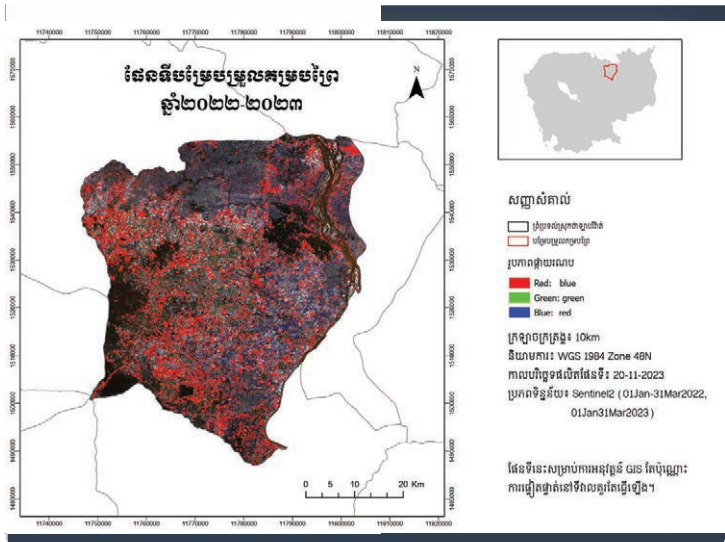
ប្រសិនបើអ្នកចង់ដឹងទំហំ/If you want to calculate area

❖ ការស្វែងរកទំហំប្រែប្រួល/Calculate changed area ( បន្ត ) ៖

- មើលស្តាប់លើ/Right click: **Area**
- ជ្រើសរើស/Select: **Calculate Geometry**
- ជ្រើសរើស/Select: **Area**
- ជ្រើសរើស/Select: **Hectares**
- ចុច/Click: **OK**



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[Satellite image interpretation card]

Land use/cover type : Evergreen forest, Biomass range : 400 to 500 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                  |
|--------------------------------|------------------|
| Cluster number                 | 28531            |
| Plot number                    | 3                |
| UTM Easting (Zone 48N)         | 657806           |
| UTM Northing (Zone 48N)        | 1585367          |
| Land use/cover type            | Evergreen forest |
| Disturbance                    | Not disturbed    |
| Tree canopy density (%)        | 57               |
| Above ground biomass (ton/ha)  | 468              |
| Date of inventory (dd/mm/yyyy) | 10/02/2022       |

Satellite image interpretation Key

[Landsat 8/9]

Color/Tone: (Rain season) Brownish yellow-green, (Dry season) Bright green

[Sentinel-2]

Color/Tone: (Rain season) Brownish yellow-green, (Dry season) Bright green

Texture: Overall fluffy

[NICFI Planet Basemap]

Color/Tone: Light green

Texture: Overall fluffy

Photo towards the North

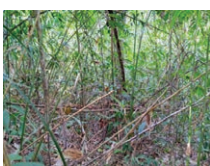


Photo towards the South



Photo towards Up



Photo towards the East



Photo towards the West

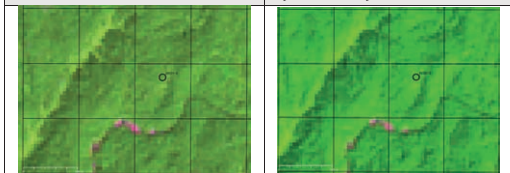


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[Satellite image interpretation card]

Land sat 8/9 R.G.B=7,5,4 (SWIR 2, NIR, Red)

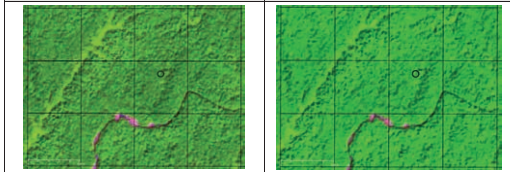
End of rain season (October to December 2021) Dry season (January to March 2022)



Sentinel-2

R.G.B=12,8,4 (SWIR 2, NIR, Red)

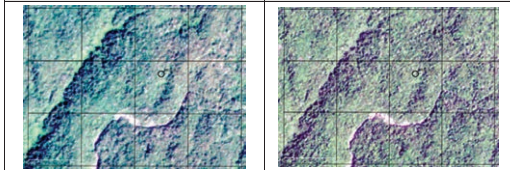
End of rain season (October to December 2021) Dry season (January to March 2022)



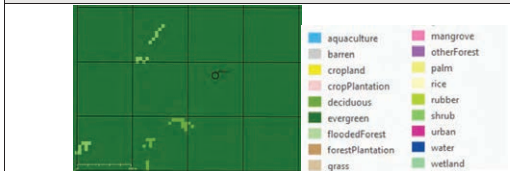
NICFI Planet Basemap

R.G.B=3,2,1 (Red, Green, Blue)

End of rain season (November 2021) Dry season (January to March 2022)



Land cover map 2022 by SERVIR SEA



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[Satellite image interpretation card]

Land use/cover type : Evergreen forest, Biomass range : 500 to 600 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                    |
|--------------------------------|--------------------|
| Cluster number                 | 32041              |
| Plot number                    | 2                  |
| UTM Easting (Zone 48N)         | 657706             |
| UTM Northing (Zone 48N)        | 1579467            |
| Land use/cover type            | Evergreen forest   |
| Disturbance                    | Slightly disturbed |
| Tree canopy density (%)        | 59                 |
| Above ground biomass (ton/ha)  | 582                |
| Date of inventory (dd/mm/yyyy) | 08/02/2022         |

Satellite image interpretation Key

[Landsat 8/9] Color/Tone: (Rain season) Brownish yellow-green, (Dry season) Bright green

[Sentinel-2]

Color/Tone: (Rain season) Brownish yellow-green, (Dry season) Green

Texture: Overall fluffy

[NICFI Planet Basemap]

Color/Tone: (Rain season) Vivid blue-green, (Dry season) Light green

Texture: Overall fluffy

Photo towards the North



Photo towards the South



Photo towards Up



Photo towards the East



Photo towards the West

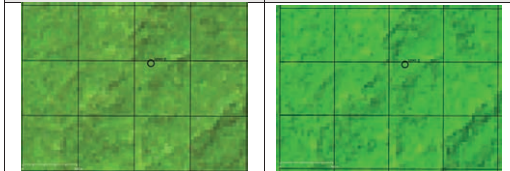


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[Satellite image interpretation card]

Land sat 8/9 R.G.B=7,5,4 (SWIR 2, NIR, Red)

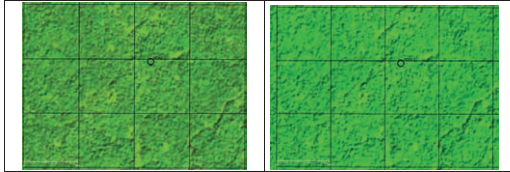
End of rain season (October to December 2021) Dry season (January to March 2022)



Sentinel-2

R.G.B=12,8,4 (SWIR 2, NIR, Red)

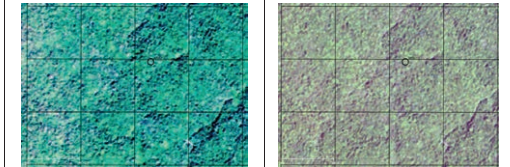
End of rain season (October to December 2021) Dry season (January to March 2022)



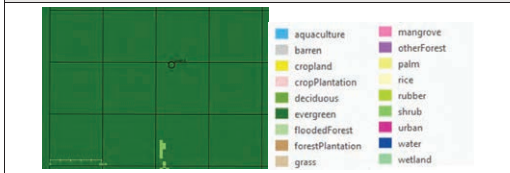
NICFI Planet Basemap

R.G.B=3,2,1 (Red, Green, Blue)

End of rain season (November 2021) Dry season (January to March 2022)



Land cover map 2022 by SERVIR SEA



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【Satellite image interpretation card】

Land use/cover type : Evergreen forest, Biomass range : 600 to 700 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                      |
|--------------------------------|----------------------|
| Cluster number                 | 42595                |
| Plot number                    | 3                    |
| UTM Easting (Zone 48N)         | 681806               |
| UTM Northing (Zone 48N)        | 1561367              |
| Land use/cover type            | Evergreen forest     |
| Disturbance                    | Moderately disturbed |
| Tree canopy density (%)        | 78                   |
| Above ground biomass (ton/ha)  | 657                  |
| Date of inventory (dd/mm/yyyy) | 11/02/2022           |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Brownish green

【Sentinel-2】

Color/Tone: Brownish green

Texture: Overall fluffy

【NICFI Planet Basemap】

Color/Tone: (Rain season) Grayish light pink,  
(Dry season) Light green

Texture: Overall fluffy

Photo towards the North



Photo towards the East



Photo towards the South



Photo towards the West

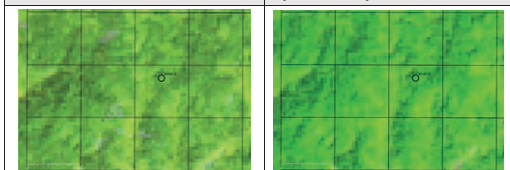


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【Satellite image interpretation card】

Landsat 8/9 R,G,B=7,5,4 (SWIR 2, NIR, Red)

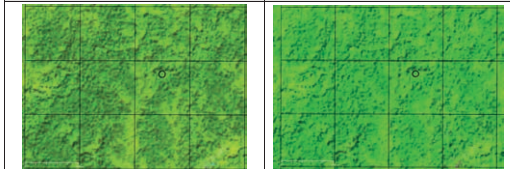
End of rain season (October to December 2021) Dry season (January to March 2022)



Sentinel-2

R,G,B=12,8,4 (SWIR 2, NIR, Red)

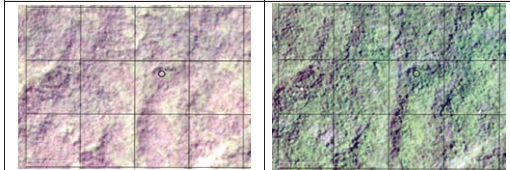
End of rain season (October to December 2021) Dry season (January to March 2022)



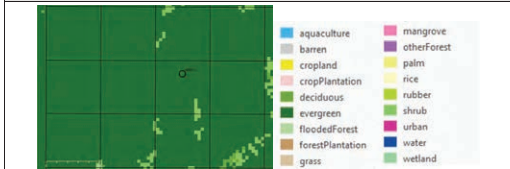
NICFI Planet Basemap

R,G,B=3,2,1 (Red, Green, Blue)

End of rain season (November 2021) Dry season (January to March 2022)



Land cover map of 2022 by SERVIR SEA



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【Satellite image interpretation card】

Land use/cover type : Deciduous forest, Biomass range : More than 300 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                      |
|--------------------------------|----------------------|
| Cluster number                 | 46099                |
| Plot number                    | 2                    |
| UTM Easting (Zone 48N)         | 675706               |
| UTM Northing (Zone 48N)        | 1555467              |
| Land use/cover type            | Deciduous forest     |
| Disturbance                    | Moderately disturbed |
| Tree canopy density (%)        | 78                   |
| Above ground biomass (ton/ha)  | 319                  |
| Date of inventory (dd/mm/yyyy) | 10/02/2022           |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Brownish green

【Sentinel-2】

Color/Tone: Brownish green

Texture: Granular tree crowns visible

【NICFI Planet Basemap】

Color/Tone: (Rain season) Between gray and dark brown, (Dry season) White

Texture: Granular tree crowns visible

Photo towards the North



Photo towards the East



Photo towards the South



Photo towards the West

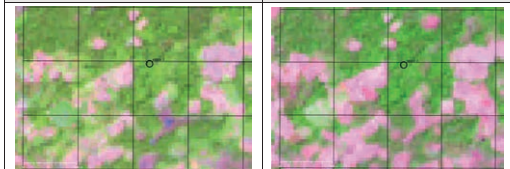


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【Satellite image interpretation card】

Landsat 8/9 R,G,B=7,5,4 (SWIR 2, NIR, Red)

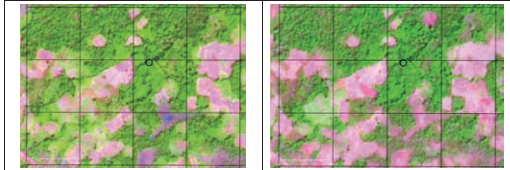
End of rain season (October to December 2021) Dry season (January to March 2022)



Sentinel-2

R,G,B=12,8,4 (SWIR 2, NIR, Red)

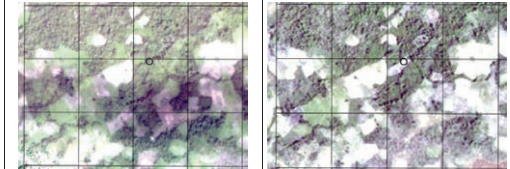
End of rain season (October to December 2021) Dry season (January to March 2022)



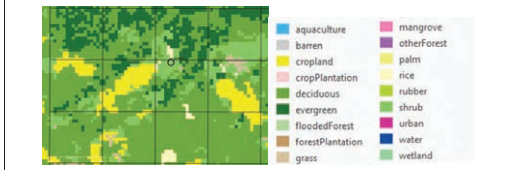
NICFI Planet Basemap

R,G,B=3,2,1 (Red, Green, Blue)

End of rain season (November 2021) Dry season (January to March 2022)



Land cover map 2022 by SERVIR SEA



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【Satellite image interpretation card】

Land use/cover type : Semi-evergreen forest, Biomass range : 100 to 200 ton/ha

| Forest inventory information: Forest inventory of Stung Treng province in 2022 |                       |
|--------------------------------------------------------------------------------|-----------------------|
| Cluster number                                                                 | 53095                 |
| Plot number                                                                    | 3                     |
| UTM Easting (Zone 48N)                                                         | 651806                |
| UTM Northing (Zone 48N)                                                        | 1543367               |
| Land use/cover type                                                            | Semi-evergreen forest |
| Disturbance                                                                    | Not disturbed         |
| Tree canopy density (%)                                                        | 71                    |
| Above ground biomass (ton/ha)                                                  | 123                   |
| Date of inventory (dd/mm/yyyy)                                                 | 04/02/2022            |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Brownish green

【Sentinel-2】

Color/Tone: Brownish green

Texture: Granular tree crowns are visible, and the overall appearance is rough.

【NICFI Planet Basemap】

Color/Tone: (Dry season) Dark green

Texture: Granular tree crowns are visible, and the overall appearance is rough.

Photo towards the North

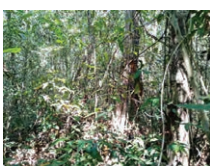


Photo towards the South



Photo towards Up



Photo towards the East



Photo towards the West



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【Satellite image interpretation card】

Land use/cover type : Semi-evergreen forest, Biomass range : 100 to 200 ton/ha

| Forest inventory information: Forest inventory of Stung Treng province in 2022 |                       |
|--------------------------------------------------------------------------------|-----------------------|
| Cluster number                                                                 | 53095                 |
| Plot number                                                                    | 3                     |
| UTM Easting (Zone 48N)                                                         | 651806                |
| UTM Northing (Zone 48N)                                                        | 1543367               |
| Land use/cover type                                                            | Semi-evergreen forest |
| Disturbance                                                                    | Not disturbed         |
| Tree canopy density (%)                                                        | 71                    |
| Above ground biomass (ton/ha)                                                  | 123                   |
| Date of inventory (dd/mm/yyyy)                                                 | 04/02/2022            |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Brownish green

【Sentinel-2】

Color/Tone: Brownish green

Texture: Granular tree crowns are visible, and the overall appearance is rough.

【NICFI Planet Basemap】

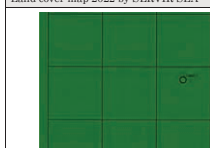
Color/Tone: (Dry season) Dark green

Texture: Granular tree crowns are visible, and the overall appearance is rough.

Photo towards the North



Photo towards the South



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【Satellite image interpretation card】

Land use/cover type : Deciduous forest, Biomass range : 100 to 200 ton/ha

| Forest inventory information: Forest inventory of Stung Treng province in 2022 |                      |
|--------------------------------------------------------------------------------|----------------------|
| Cluster number                                                                 | 56587                |
| Plot number                                                                    | 3                    |
| UTM Easting (Zone 48N)                                                         | 633806               |
| UTM Northing (Zone 48N)                                                        | 1537367              |
| Land use/cover type                                                            | Deciduous forest     |
| Disturbance                                                                    | Moderately disturbed |
| Tree canopy density (%)                                                        | 49                   |
| Above ground biomass (ton/ha)                                                  | 170                  |
| Date of inventory (dd/mm/yyyy)                                                 | 14/02/2022           |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Yellowish green with a brownish tint

【Sentinel-2】

Color/Tone: Yellowish green with a brownish tint

Texture: The tree crowns appear granular, giving an overall rough appearance.

【NICFI Planet Basemap】

Color/Tone: (Dry season) Gray

Texture: The tree crowns appear granular, giving an overall rough appearance.

Photo towards the North



Photo towards the South



Photo towards Up

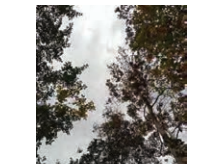


Photo towards the East



Photo towards the West



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【Satellite image interpretation card】

Land use/cover type : Deciduous forest, Biomass range : 100 to 200 ton/ha

| Forest inventory information: Forest inventory of Stung Treng province in 2022 |                      |
|--------------------------------------------------------------------------------|----------------------|
| Cluster number                                                                 | 56587                |
| Plot number                                                                    | 3                    |
| UTM Easting (Zone 48N)                                                         | 633806               |
| UTM Northing (Zone 48N)                                                        | 1537367              |
| Land use/cover type                                                            | Deciduous forest     |
| Disturbance                                                                    | Moderately disturbed |
| Tree canopy density (%)                                                        | 49                   |
| Above ground biomass (ton/ha)                                                  | 170                  |
| Date of inventory (dd/mm/yyyy)                                                 | 14/02/2022           |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Yellowish green with a brownish tint

【Sentinel-2】

Color/Tone: Yellowish green with a brownish tint

Texture: The tree crowns appear granular, giving an overall rough appearance.

【NICFI Planet Basemap】

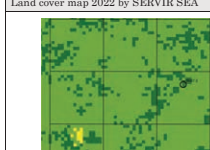
Color/Tone: (Dry season) Gray

Texture: The tree crowns appear granular, giving an overall rough appearance.

Photo towards the North



Photo towards the South



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【Satellite image interpretation card】

Land use/cover type : Evergreen forest, Biomass range : Less than 100 ton/ha

| Forest inventory information: Forest inventory of Stung Treng province in 2022 |                      |
|--------------------------------------------------------------------------------|----------------------|
| Cluster number                                                                 | 56617                |
| Plot number                                                                    | 1                    |
| UTM Easting (Zone 48N)                                                         | 663706               |
| UTM Northing (Zone 48N)                                                        | 1537367              |
| Land use/cover type                                                            | Evergreen forest     |
| Disturbance                                                                    | Moderately disturbed |
| Tree canopy density (%)                                                        | 71                   |
| Above ground biomass (ton/ha)                                                  | 55                   |
| Date of inventory (dd/mm/yyyy)                                                 | 02/02/2022           |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Yellowish-green with a brownish tint

【Sentinel-2】

Color/Tone: Bright yellow-green

Texture: The tree crowns appear granular, giving an overall rough appearance.

【NICFI Planet Basemap】

Color/Tone: (Rain season) Deep green, (Dry season) Light green

Texture: The tree crowns appear granular, giving an overall rough appearance.

Photo towards the North



Photo towards the East



Photo towards the South

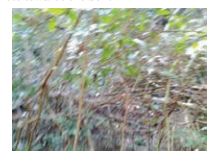


Photo towards the West



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【Satellite image interpretation card】

Land use/cover type : Evergreen forest, Biomass range : More than 100 ton/ha

| Forest inventory information: Forest inventory of Stung Treng province in 2022 |                  |
|--------------------------------------------------------------------------------|------------------|
| Cluster number                                                                 | 56623            |
| Plot number                                                                    | 2                |
| UTM Easting (Zone 48N)                                                         | 669706           |
| UTM Northing (Zone 48N)                                                        | 1537467          |
| Land use/cover type                                                            | Evergreen forest |
| Disturbance                                                                    | Not disturbed    |
| Tree canopy density (%)                                                        | 69               |
| Above ground biomass (ton/ha)                                                  | 917              |
| Date of inventory (dd/mm/yyyy)                                                 | 30/01/2022       |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Yellowish-green with a brownish tint

【Sentinel-2】

Color/Tone: Bright yellow-green

Texture: The tree crowns vary in size, giving an overall rough appearance.

【NICFI Planet Basemap】

Color/Tone: (Rain season) Deep green, (Dry season) Light green

Texture: The tree crowns appear granular, giving an overall rough appearance.

Photo towards the North

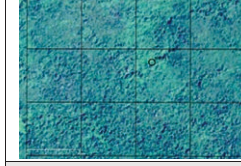


Photo towards the East



Photo towards the South

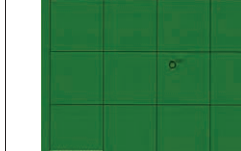


Photo towards the West



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【Satellite image interpretation card】

Land use/cover type : Evergreen forest, Biomass range : More than 700 ton/ha

| Forest inventory information: Forest inventory of Stung Treng province in 2022 |                  |
|--------------------------------------------------------------------------------|------------------|
| Cluster number                                                                 | 56623            |
| Plot number                                                                    | 2                |
| UTM Easting (Zone 48N)                                                         | 669706           |
| UTM Northing (Zone 48N)                                                        | 1537467          |
| Land use/cover type                                                            | Evergreen forest |
| Disturbance                                                                    | Not disturbed    |
| Tree canopy density (%)                                                        | 69               |
| Above ground biomass (ton/ha)                                                  | 917              |
| Date of inventory (dd/mm/yyyy)                                                 | 30/01/2022       |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Yellowish-green

【Sentinel-2】

Color/Tone: Bright yellow-green

Texture: The tree crowns vary in size, giving an overall rough appearance.

【NICFI Planet Basemap】

Color/Tone: (Rain season) Deep green, (Dry season) Light green

Texture: The tree crowns appear granular, giving an overall rough appearance.

Photo towards the North



Photo towards the East



Photo towards the South



Photo towards the West



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【Satellite image interpretation card】

Land use/cover type : Evergreen forest, Biomass range : More than 700 ton/ha

| Forest inventory information: Forest inventory of Stung Treng province in 2022 |                  |
|--------------------------------------------------------------------------------|------------------|
| Cluster number                                                                 | 56623            |
| Plot number                                                                    | 2                |
| UTM Easting (Zone 48N)                                                         | 669706           |
| UTM Northing (Zone 48N)                                                        | 1537467          |
| Land use/cover type                                                            | Evergreen forest |
| Disturbance                                                                    | Not disturbed    |
| Tree canopy density (%)                                                        | 69               |
| Above ground biomass (ton/ha)                                                  | 917              |
| Date of inventory (dd/mm/yyyy)                                                 | 30/01/2022       |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Yellowish-green with a brownish tint

【Sentinel-2】

Color/Tone: Bright yellow-green

Texture: The tree crowns vary in size, giving an overall rough appearance.

【NICFI Planet Basemap】

Color/Tone: (Rain season) Deep green, (Dry season) Light green

Texture: The tree crowns appear granular, giving an overall rough appearance.

Photo towards the North



Photo towards the East



Photo towards the South

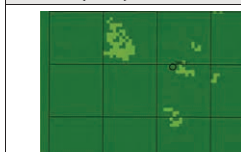
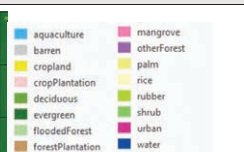


Photo towards the West



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【Satellite image interpretation card】

Land use/cover type : Evergreen forest, Biomass range : 100 to 200 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                  |
|--------------------------------|------------------|
| Cluster number                 | 60109            |
| Plot number                    | 1                |
| UTM Easting (Zone 48N)         | 645706           |
| UTM Northing (Zone 48N)        | 1531367          |
| Land use/cover type            | Evergreen forest |
| Disturbance                    | Not disturbed    |
| Tree canopy density (%)        | 65               |
| Above ground biomass (ton/ha)  | 159              |
| Date of inventory (dd/mm/yyyy) | 03/02/2022       |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Green with a brownish tint

【Sentinel-2】

Color/Tone: Green with a brownish tint

Texture: Appears overall rough.

【NICFI Planet Basemap】

Color/Tone: (Rain season) Brick red, (Dry season) Dark green

Texture: Appears overall rough.

Photo towards the North



Photo towards Up



Photo towards the East



Photo towards the South



Photo towards the West



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【Satellite image interpretation card】

Land use/cover type : Evergreen forest, Biomass range : 100 to 200 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                  |
|--------------------------------|------------------|
| Cluster number                 | 60109            |
| Plot number                    | 1                |
| UTM Easting (Zone 48N)         | 645706           |
| UTM Northing (Zone 48N)        | 1531367          |
| Land use/cover type            | Evergreen forest |
| Disturbance                    | Not disturbed    |
| Tree canopy density (%)        | 65               |
| Above ground biomass (ton/ha)  | 159              |
| Date of inventory (dd/mm/yyyy) | 03/02/2022       |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Green with a brownish tint

【Sentinel-2】

Color/Tone: Green with a brownish tint

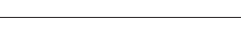
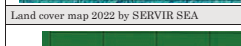
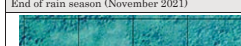
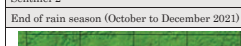
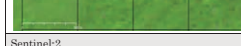
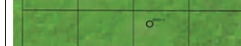
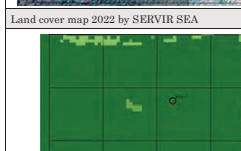
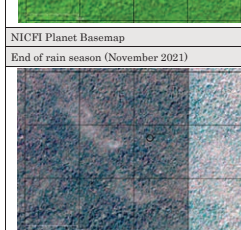
Texture: Appears overall rough.

【NICFI Planet Basemap】

Color/Tone: (Rain season) Brick red, (Dry season) Dark green

Texture: Appears overall rough.

Photo towards the North



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【Satellite image interpretation card】

Land use/cover type : Semi-evergreen forest, Biomass range : Less than 100 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                       |
|--------------------------------|-----------------------|
| Cluster number                 | 60127                 |
| Plot number                    | 1                     |
| UTM Easting (Zone 48N)         | 663706                |
| UTM Northing (Zone 48N)        | 1531367               |
| Land use/cover type            | Semi-evergreen forest |
| Disturbance                    | Slightly disturbed    |
| Tree canopy density (%)        | 72                    |
| Above ground biomass (ton/ha)  | 56                    |
| Date of inventory (dd/mm/yyyy) | 03/02/2022            |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Yellowish green with a brownish tint

【Sentinel-2】

Color/Tone: Yellowish green with a brownish tint

Texture: The tree crowns are not distinct, giving an overall flat appearance.

【NICFI Planet Basemap】

Color/Tone: (Rain season) Blue-green, (Dry season) Bright yellow-green

Texture: The tree crowns are not distinct, giving an overall flat appearance.

Photo towards the North



Photo towards Up



Photo towards the East



Photo towards the South



Photo towards the West



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【Satellite image interpretation card】

Land use/cover type : Semi-evergreen forest, Biomass range : Less than 100 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                       |
|--------------------------------|-----------------------|
| Cluster number                 | 60127                 |
| Plot number                    | 1                     |
| UTM Easting (Zone 48N)         | 663706                |
| UTM Northing (Zone 48N)        | 1531367               |
| Land use/cover type            | Semi-evergreen forest |
| Disturbance                    | Slightly disturbed    |
| Tree canopy density (%)        | 72                    |
| Above ground biomass (ton/ha)  | 56                    |
| Date of inventory (dd/mm/yyyy) | 03/02/2022            |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Yellowish green with a brownish tint

【Sentinel-2】

Color/Tone: Yellowish green with a brownish tint

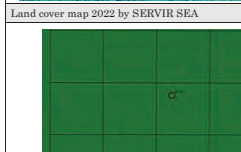
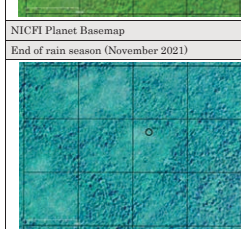
Texture: The tree crowns are not distinct, giving an overall flat appearance.

【NICFI Planet Basemap】

Color/Tone: (Rain season) Blue-green, (Dry season) Bright yellow-green

Texture: The tree crowns are not distinct, giving an overall flat appearance.

Photo towards the North



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[Satellite image interpretation card]

Land use/cover type : Deciduous forest, Biomass range : Less than 100 ton/ha

| Forest inventory information: Forest inventory of Stung Treng province in 2022 |                  |
|--------------------------------------------------------------------------------|------------------|
| Cluster number                                                                 | 63643            |
| Plot number                                                                    | 1                |
| UTM Easting (Zone 48N)                                                         | 669706           |
| UTM Northing (Zone 48N)                                                        | 1525367          |
| Land use/cover type                                                            | Deciduous forest |
| Disturbance                                                                    | Not disturbed    |
| Tree canopy density (%)                                                        | 61               |
| Above ground biomass (ton/ha)                                                  | 58               |
| Date of inventory (dd/mm/yyyy)                                                 | 01/02/2022       |

Satellite image interpretation Key

[Landsat 8/9]

Color/Tone: Pink

[Sentinel-2]

Color/Tone: Yellow-green mixed with pink

Texture: The tree crowns are not distinct, giving a flat appearance.

[NICFI Planet Basemap]

Color/Tone: White

Texture: The tree crowns are not distinct, giving a flat appearance.

Photo towards the North



Photo towards the East



Photo towards the South



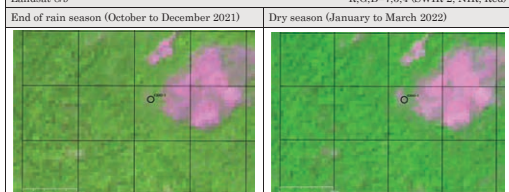
Photo towards the West



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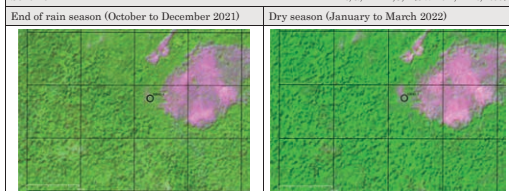
[Satellite image interpretation card]

Land use/cover type : Deciduous forest, Biomass range : Less than 100 ton/ha



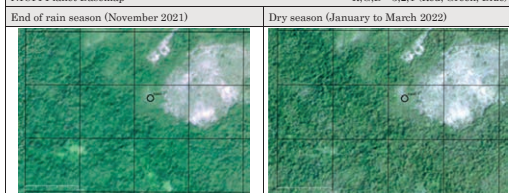
Sentinel-2

R,G,B=12,8,4 (SWIR 2, NIR, Red)

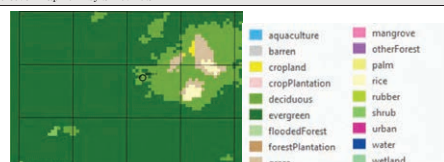


NICFI Planet Basemap

R,G,B=3,2,1 (Red, Green, Blue)



Land cover map 2022 by SERVIR SEA



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[Satellite image interpretation card]

Land use/cover type : Grassland, Biomass range : - ton/ha

| Forest inventory information: Forest inventory of Stung Treng province in 2022 |                      |
|--------------------------------------------------------------------------------|----------------------|
| Cluster number                                                                 | 67069                |
| Plot number                                                                    | 3                    |
| UTM Easting (Zone 48N)                                                         | 585806               |
| UTM Northing (Zone 48N)                                                        | 1519367              |
| Land use/cover type                                                            | Grassland            |
| Disturbance                                                                    | Moderately disturbed |
| Tree canopy density (%)                                                        | 11                   |
| Above ground biomass (ton/ha)                                                  | 0                    |
| Date of inventory (dd/mm/yyyy)                                                 | 27/03/2022           |

Satellite image interpretation Key

[Landsat 8/9]

Color/Tone: Bright yellow-green

[Sentinel-2]

Color/Tone: Bright yellow-green

Texture: Appears overall smooth, like a carpet.

[NICFI Planet Basemap]

Color/Tone: Deep green

Texture: Appears overall smooth, like a carpet.

Photo towards the North



Photo towards the East



Photo towards the South



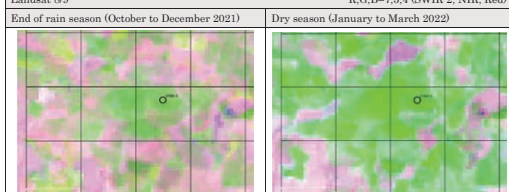
Photo towards the West



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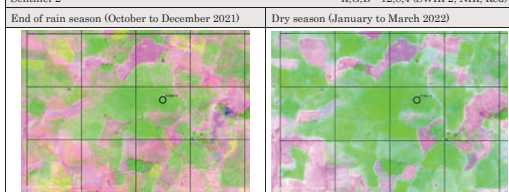
[Satellite image interpretation card]

Land use/cover type : Grassland, Biomass range : - ton/ha



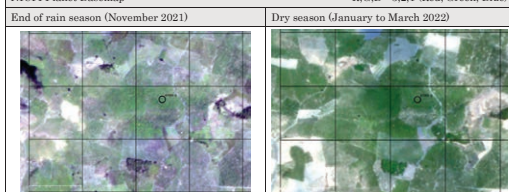
Sentinel-2

R,G,B=12,8,4 (SWIR 2, NIR, Red)

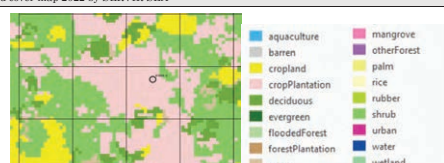


NICFI Planet Basemap

R,G,B=3,2,1 (Red, Green, Blue)



Land cover map 2022 by SERVIR SEA



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【Satellite image interpretation card】

Land use/cover type : Cropland, Biomass range : ~ ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                      |
|--------------------------------|----------------------|
| Cluster number                 | 70591                |
| Plot number                    | 1                    |
| UTM Easting (Zone 48N)         | 597706               |
| UTM Northing (Zone 48N)        | 1513367              |
| Land use/cover type            | Cropland             |
| Disturbance                    | Moderately disturbed |
| Tree canopy density (%)        | 0                    |
| Above ground biomass (ton/ha)  | 0                    |
| Date of inventory (dd/mm/yyyy) | 30/03/2022           |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: (Rain season) Light yellow-green,  
(Dry season) Gray mixed with pink

【Sentinel-2】

Color/Tone: (Rain season) Yellow-green with  
slight pink, (Dry season) Pinkish gray

Texture: Appears smooth like a carpet.

【NICFI Planet Basemap】

Color/Tone: (Rain season) Light green, (Dry  
season) Brown

Texture: Appears smooth like a carpet.

Photo towards the North



Photo towards the East



Photo towards the South



Photo towards the West

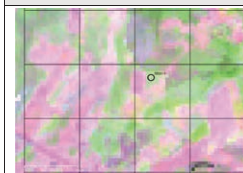


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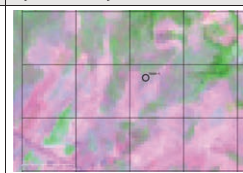
【Satellite image interpretation card】

Land sat 8/9 R.G.B=7,5,4 (SWIR 2, NIR, Red)

End of rain season (October to December 2021)



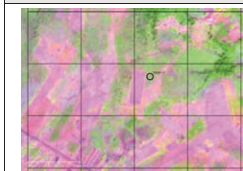
Dry season (January to March 2022)



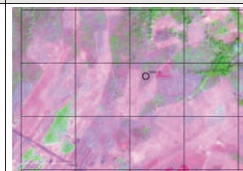
Sentinel-2

R.G.B=12,8,4 (SWIR 2, NIR, Red)

End of rain season (October to December 2021)



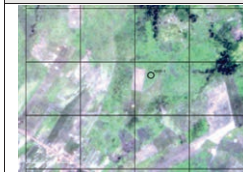
Dry season (January to March 2022)



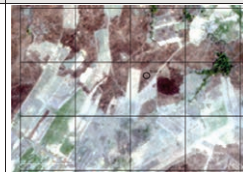
NICFI Planet Basemap

R.G.B=3,2,1 (Red, Green, Blue)

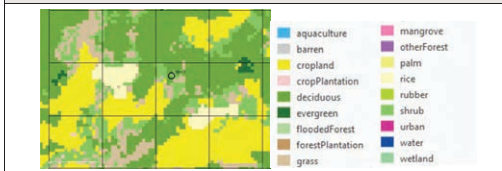
End of rain season (November 2021)



Dry season (January to March 2022)



Land cover map 2022 by SERVIR SEA



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【Satellite image interpretation card】

Land use/cover type : Shrubland, Biomass range : ~ ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                      |
|--------------------------------|----------------------|
| Cluster number                 | 74101                |
| Plot number                    | 2                    |
| UTM Easting (Zone 48N)         | 597706               |
| UTM Northing (Zone 48N)        | 1507467              |
| Land use/cover type            | Shrubland            |
| Disturbance                    | Moderately disturbed |
| Tree canopy density (%)        | 38                   |
| Above ground biomass (ton/ha)  | 0                    |
| Date of inventory (dd/mm/yyyy) | 29/03/2022           |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: (Rain season) Gray, (Dry season)  
Dark pink

【Sentinel-2】

Color/Tone: (Rain season) Brownish pink,  
(Dry season) Dark pink

Texture: Appears smooth like a carpet.

【NICFI Planet Basemap】

Color/Tone: (Rain season) Gray, (Dry season)  
Whitish dark brown

Texture: Appears smooth like a carpet.

Photo towards the North



Photo towards the East



Photo towards the South



Photo towards the West

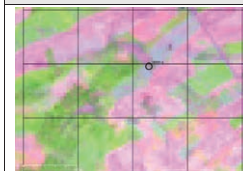


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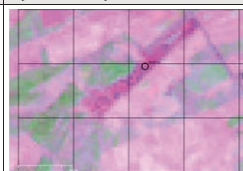
【Satellite image interpretation card】

Land sat 8/9 R.G.B=7,5,4 (SWIR 2, NIR, Red)

End of rain season (October to December 2021)



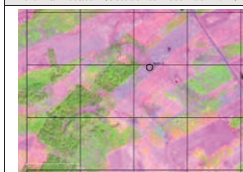
Dry season (January to March 2022)



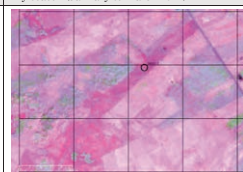
Sentinel-2

R.G.B=12,8,4 (SWIR 2, NIR, Red)

End of rain season (October to December 2021)



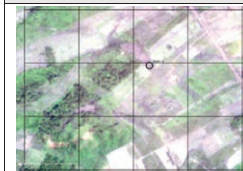
Dry season (January to March 2022)



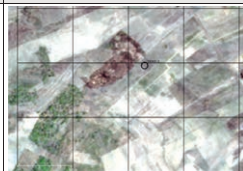
NICFI Planet Basemap

R.G.B=3,2,1 (Red, Green, Blue)

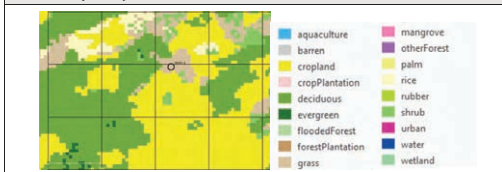
End of rain season (November 2021)



Dry season (January to March 2022)



Land cover map 2022 by SERVIR SEA



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【Satellite image interpretation card】

Land use/cover type : Deciduous forest, Biomass range : 200 to 300 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                  |
|--------------------------------|------------------|
| Cluster number                 | 91633            |
| Plot number                    | 1                |
| UTM Easting (Zone 48N)         | 579706           |
| UTM Northing (Zone 48N)        | 1477367          |
| Land use/cover type            | Deciduous forest |
| Disturbance                    | Not disturbed    |
| Tree canopy density (%)        | 58               |
| Above ground biomass (ton/ha)  | 263              |
| Date of inventory (dd/mm/yyyy) | 26/01/2022       |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: (Rain season) Grayish blue-green,  
(Dry season) Brownish yellow-green

【Sentinel-2】

Color/Tone: Brownish yellow-green

Texture: Fluffy appearance

【NICFI Planet Basemap】

Color/Tone: (Rain season) Ochre, (Dry season)  
Between gray and dark brown

Texture: Fluffy appearance

Photo towards the North



Photo towards the South



Photo towards Up



Photo towards the East



Photo towards the West



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【Satellite image interpretation card】

Land use/cover type : Deciduous forest, Biomass range : 200 to 300 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                  |
|--------------------------------|------------------|
| Cluster number                 | 91633            |
| Plot number                    | 1                |
| UTM Easting (Zone 48N)         | 579706           |
| UTM Northing (Zone 48N)        | 1477367          |
| Land use/cover type            | Deciduous forest |
| Disturbance                    | Not disturbed    |
| Tree canopy density (%)        | 58               |
| Above ground biomass (ton/ha)  | 263              |
| Date of inventory (dd/mm/yyyy) | 26/01/2022       |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: (Rain season) Grayish blue-green,  
(Dry season) Brownish yellow-green

【Sentinel-2】

Color/Tone: Brownish yellow-green

Texture: Fluffy appearance

【NICFI Planet Basemap】

Color/Tone: (Rain season) Ochre, (Dry season)  
Between gray and dark brown

Texture: Fluffy appearance

Photo towards the North

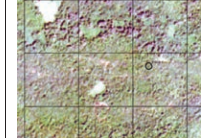


Photo towards the South

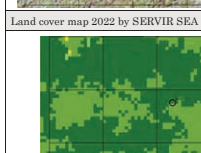


Photo towards Up



Photo towards the East

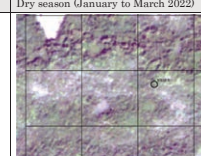
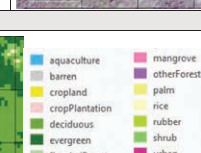


Photo towards the West



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【Satellite image interpretation card】

Land use/cover type : Evergreen forest, Biomass range : 300 to 400 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                    |
|--------------------------------|--------------------|
| Cluster number                 | 95125              |
| Plot number                    | 1                  |
| UTM Easting (Zone 48N)         | 561706             |
| UTM Northing (Zone 48N)        | 1471367            |
| Land use/cover type            | Evergreen forest   |
| Disturbance                    | Slightly disturbed |
| Tree canopy density (%)        | 65                 |
| Above ground biomass (ton/ha)  | 351                |
| Date of inventory (dd/mm/yyyy) | 20/01/2022         |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Brownish yellow-green

【Sentinel-2】

Color/Tone: Brownish yellow-green

Texture: The tree crowns are visible, giving  
an overall rough appearance.

【NICFI Planet Basemap】

Color/Tone: (Rain season) White, (Dry season)  
Gray

Texture: The tree crowns are visible, giving  
an overall rough appearance.

Photo towards the North

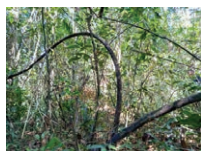


Photo towards the South



Photo towards Up



Photo towards the East



Photo towards the West



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【Satellite image interpretation card】

Land use/cover type : Evergreen forest, Biomass range : 300 to 400 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                    |
|--------------------------------|--------------------|
| Cluster number                 | 95125              |
| Plot number                    | 1                  |
| UTM Easting (Zone 48N)         | 561706             |
| UTM Northing (Zone 48N)        | 1471367            |
| Land use/cover type            | Evergreen forest   |
| Disturbance                    | Slightly disturbed |
| Tree canopy density (%)        | 65                 |
| Above ground biomass (ton/ha)  | 351                |
| Date of inventory (dd/mm/yyyy) | 20/01/2022         |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Brownish yellow-green

【Sentinel-2】

Color/Tone: Brownish yellow-green

Texture: The tree crowns are visible, giving  
an overall rough appearance.

【NICFI Planet Basemap】

Color/Tone: (Rain season) White, (Dry season)  
Gray

Texture: The tree crowns are visible, giving  
an overall rough appearance.

Photo towards the North



Photo towards the South

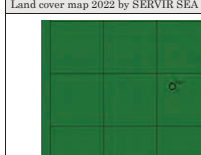


Photo towards Up

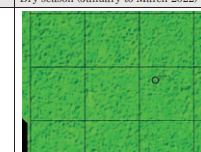
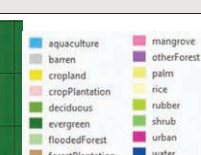


Photo towards the East



Photo towards the West



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【Satellite image interpretation card】

Land use/cover type : Semi-evergreen forest, Biomass range : 200 to 300 ton/ha

| Forest inventory information: Forest inventory of Stung Treng province in 2022 |                       |
|--------------------------------------------------------------------------------|-----------------------|
| Cluster number                                                                 | 95143                 |
| Plot number                                                                    | 3                     |
| UTM Easting (Zone 48N)                                                         | 579806                |
| UTM Northing (Zone 48N)                                                        | 1471367               |
| Land use/cover type                                                            | Semi-evergreen forest |
| Disturbance                                                                    | Slightly disturbed    |
| Tree canopy density (%)                                                        | 53                    |
| Above ground biomass (ton/ha)                                                  | 209                   |
| Date of inventory (dd/mm/yyyy)                                                 | 24/01/2022            |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: (Rain season) Grayish blue-green,  
(Dry season) Brownish yellow-green

【Sentinel-2】

Color/Tone: Brownish yellow-green

Texture: The tree crowns are indistinct but appear rough.

【NICFI Planet Basemap】

Color/Tone: (Rain season) Ochre, (Dry season)  
Grayish dark brown

Texture: The tree crowns are indistinct but appear rough.

Photo towards the North

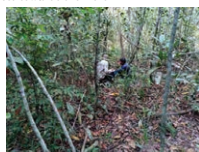


Photo towards the East



Photo towards the South



Photo towards the West



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【Satellite image interpretation card】

| Landsat 8/9                                   |  | R,G,B=7,5,4 (SWIR 2, NIR, Red)     |  |
|-----------------------------------------------|--|------------------------------------|--|
| End of rain season (October to December 2021) |  | Dry season (January to March 2022) |  |
|                                               |  |                                    |  |

| Sentinel-2                                    |  | R,G,B=12,8,4 (SWIR 2, NIR, Red)    |  |
|-----------------------------------------------|--|------------------------------------|--|
| End of rain season (October to December 2021) |  | Dry season (January to March 2022) |  |
|                                               |  |                                    |  |

| NICFI Planet Basemap               |  | R,G,B=3,2,1 (Red, Green, Blue)     |  |
|------------------------------------|--|------------------------------------|--|
| End of rain season (November 2021) |  | Dry season (January to March 2022) |  |
|                                    |  |                                    |  |

| Land cover map 2022 by SERVIR SEA |  |
|-----------------------------------|--|
|                                   |  |

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【Satellite image interpretation card】

Land use/cover type : Evergreen forest, Biomass range : 200 to 300 ton/ha

| Forest inventory information: Forest inventory of Stung Treng province in 2022 |                  |
|--------------------------------------------------------------------------------|------------------|
| Cluster number                                                                 | 102169           |
| Plot number                                                                    | 1                |
| UTM Easting (Zone 48N)                                                         | 585706           |
| UTM Northing (Zone 48N)                                                        | 1459367          |
| Land use/cover type                                                            | Evergreen forest |
| Disturbance                                                                    | Not disturbed    |
| Tree canopy density (%)                                                        | 67               |
| Above ground biomass (ton/ha)                                                  | 238              |
| Date of inventory (dd/mm/yyyy)                                                 | 22/01/2022       |

Satellite image interpretation Key

【Landsat 8/9】

Color/Tone: Brownish yellow-green

【Sentinel-2】

Color/Tone: Brownish yellow-green

Texture: The tree crowns appear granular,  
giving an overall rough appearance.

【NICFI Planet Basemap】

Color/Tone: (Rain season) Grayish blue-green,  
(Dry season) Gray

Texture: The tree crowns appear granular,  
giving an overall rough appearance.

Photo towards the North



Photo towards the East



Photo towards the South



Photo towards the West



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【Satellite image interpretation card】

| Landsat 8/9                                   |  | R,G,B=7,5,4 (SWIR 2, NIR, Red)     |  |
|-----------------------------------------------|--|------------------------------------|--|
| End of rain season (October to December 2021) |  | Dry season (January to March 2022) |  |
|                                               |  |                                    |  |

| Sentinel-2                                    |  | R,G,B=12,8,4 (SWIR 2, NIR, Red)    |  |
|-----------------------------------------------|--|------------------------------------|--|
| End of rain season (October to December 2021) |  | Dry season (January to March 2022) |  |
|                                               |  |                                    |  |

| NICFI Planet Basemap               |  | R,G,B=3,2,1 (Red, Green, Blue)     |  |
|------------------------------------|--|------------------------------------|--|
| End of rain season (November 2021) |  | Dry season (January to March 2022) |  |
|                                    |  |                                    |  |

| Land cover map 2022 by SERVIR SEA |  |
|-----------------------------------|--|
|                                   |  |

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[Satellite image interpretation card]

Land use/cover type : Semi-evergreen forest, Biomass range : 300 to 400 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                       |
|--------------------------------|-----------------------|
| Cluster number                 | 105691                |
| Plot number                    | 3                     |
| UTM Easting (Zone 48N)         | 597806                |
| UTM Northing (Zone 48N)        | 1453367               |
| Land use/cover type            | Semi-evergreen forest |
| Disturbance                    | Moderately disturbed  |
| Tree canopy density (%)        | 72                    |
| Above ground biomass (ton/ha)  | 317                   |
| Date of inventory (dd/mm/yyyy) | 26/01/2022            |

Satellite image interpretation Key

[Landsat 8/9]

Color/Tone: Brownish yellow-green

[Sentinel-2]

Color/Tone: Brownish yellow-green

Texture: The tree crowns are not distinct, but overall it appears rough.

[NICFI Planet Basemap]

Color/Tone: (Dry season) Deep green

Texture: The tree crowns are visible, giving an overall fluffy appearance.

Photo towards the North



Photo towards the South



Photo towards Up



Photo towards the East

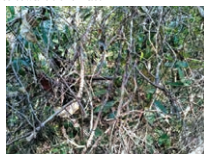
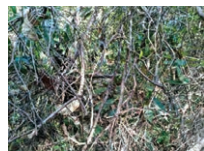


Photo towards the West



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[Satellite image interpretation card]

Land use/cover type : Semi-evergreen forest, Biomass range : 300 to 400 ton/ha

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                       |
|--------------------------------|-----------------------|
| Cluster number                 | 105691                |
| Plot number                    | 3                     |
| UTM Easting (Zone 48N)         | 597806                |
| UTM Northing (Zone 48N)        | 1453367               |
| Land use/cover type            | Semi-evergreen forest |
| Disturbance                    | Moderately disturbed  |
| Tree canopy density (%)        | 72                    |
| Above ground biomass (ton/ha)  | 317                   |
| Date of inventory (dd/mm/yyyy) | 26/01/2022            |

Satellite image interpretation Key

[Landsat 8/9]

Color/Tone: Brownish yellow-green

[Sentinel-2]

Color/Tone: Brownish yellow-green

Texture: The tree crowns are not distinct, but overall it appears rough.

[NICFI Planet Basemap]

Color/Tone: (Dry season) Deep green

Texture: The tree crowns are visible, giving an overall fluffy appearance.

Photo towards the North

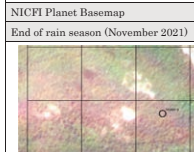


Photo towards the South



Photo towards the East

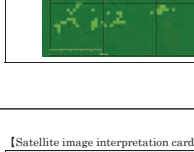


Photo towards the West

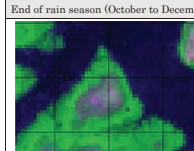


Photo towards Up



Photo towards Down

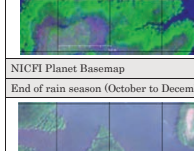


Photo towards Left



Photo towards Right

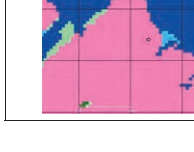


Photo towards Center



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[Satellite image interpretation card]

Land use/cover type : Mangrove

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                      |
|--------------------------------|----------------------|
| Cluster number                 | 105691               |
| Plot number                    | 3                    |
| UTM Easting (Zone 48N)         | 597806               |
| UTM Northing (Zone 48N)        | 1453367              |
| Land use/cover type            | Mangrove             |
| Disturbance                    | Moderately disturbed |
| Tree canopy density (%)        | 72                   |
| Above ground biomass (ton/ha)  | 317                  |
| Date of inventory (dd/mm/yyyy) | 26/01/2022           |

Satellite image interpretation Key

[ESRI Satellite Image]

Color/Tone: Dark green

Texture: The canopy is uniformly sized and appears smooth like a carpet.

[Landsat 8/9]

Color/Tone: Distinct light green

[Sentinel-2]

Color/Tone: Distinct light green

Texture: The edges of the canopy are almost unrecognizable.

[NICFI Planet Basemap]

Color/Tone: Dark green

Texture: The edges of the canopy are almost unrecognizable.

[ESRI Satellite Image]

Color/Tone: Dark green

Texture: The canopy is uniformly sized and appears smooth like a carpet.

[Landsat 8/9]

Color/Tone: Distinct light green

[Sentinel-2]

Color/Tone: Distinct light green

Texture: The edges of the canopy are almost unrecognizable.

[NICFI Planet Basemap]

Color/Tone: Dark green

Texture: The edges of the canopy are almost unrecognizable.

[ESRI Satellite Image]

Color/Tone: Dark green

Texture: The canopy is uniformly sized and appears smooth like a carpet.

[Landsat 8/9]

Color/Tone: Distinct light green

[Sentinel-2]

Color/Tone: Distinct light green

Texture: The edges of the canopy are almost unrecognizable.

[NICFI Planet Basemap]

Color/Tone: Dark green

Texture: The edges of the canopy are almost unrecognizable.

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[Satellite image interpretation card]

Land use/cover type : Mangrove

Forest inventory information: Forest inventory of Stung Treng province in 2022

|                                |                      |
|--------------------------------|----------------------|
| Cluster number                 | 105691               |
| Plot number                    | 3                    |
| UTM Easting (Zone 48N)         | 597806               |
| UTM Northing (Zone 48N)        | 1453367              |
| Land use/cover type            | Mangrove             |
| Disturbance                    | Moderately disturbed |
| Tree canopy density (%)        | 72                   |
| Above ground biomass (ton/ha)  | 317                  |
| Date of inventory (dd/mm/yyyy) | 26/01/2022           |

Satellite image interpretation Key

[ESRI Satellite Image]

Color/Tone: Dark green

Texture: The canopy is uniformly sized and appears smooth like a carpet.

[Landsat 8/9]

Color/Tone: Distinct light green

[Sentinel-2]

Color/Tone: Distinct light green

Texture: The edges of the canopy are almost unrecognizable.

[NICFI Planet Basemap]

Color/Tone: Dark green

Texture: The edges of the canopy are almost unrecognizable.

[ESRI Satellite Image]

Color/Tone: Dark green

Texture: The canopy is uniformly sized and appears smooth like a carpet.

[Landsat 8/9]

Color/Tone: Distinct light green

[Sentinel-2]

Color/Tone: Distinct light green

Texture: The edges of the canopy are almost unrecognizable.

[NICFI Planet Basemap]

Color/Tone: Dark green

Texture: The edges of the canopy are almost unrecognizable.

[ESRI Satellite Image]

Color/Tone: Dark green

Texture: The canopy is uniformly sized and appears smooth like a carpet.

[Landsat 8/9]

Color/Tone: Distinct light green

[Sentinel-2]

Color/Tone: Distinct light green

Texture: The edges of the canopy are almost unrecognizable.

[NICFI Planet Basemap]

Color/Tone: Dark green

Texture: The edges of the canopy are almost unrecognizable.

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【Satellite image interpretation card】

Land use/cover type : Flooded Forest

Forest inventory information:

|                                |  |
|--------------------------------|--|
| Cluster number                 |  |
| Plot number                    |  |
| UTM Easting (Zone 48N)         |  |
| UTM Northing (Zone 48N)        |  |
| Land use/cover type            |  |
| Disturbance                    |  |
| Tree canopy density (%)        |  |
| Above ground biomass (ton/ha)  |  |
| Date of inventory (dd/mm/yyyy) |  |

Satellite image interpretation Key

【ESRI Satellite Image】

Color/Tone: Overall dark green, intermixed with areas of gray and brownish green.  
Texture: Some parts show a granular appearance of the canopy, giving a rough impression.

【Landsat 8/9】

Color/Tone: A mix of brown and light green.

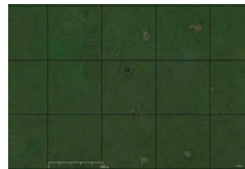
【Sentinel-2】

Color/Tone: A mix of brown and light green.  
Texture: The edges of the canopy are unrecognizable.

【NICFI Planet Basemap】

Color/Tone: Overall a mix of light green, brown, and pink.  
Texture: Some parts show a granular appearance of the canopy, giving a rough impression.

ESRI Satellite Image



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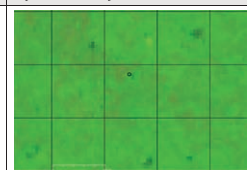
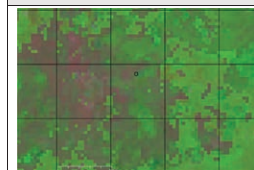
【Satellite image interpretation card】

Landsat 8/9

R,G,B=7,5,4 (SWIR 2, NIR, Red)

End of rain season (October to December 2021)

Dry season (January to March 2022)

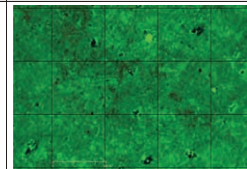
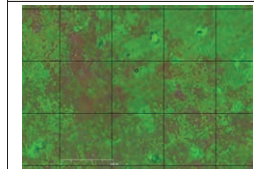


Sentinel-2

R,G,B=12,8,4 (SWIR 2, NIR, Red)

End of rain season (October to December 2021)

Dry season (January to March 2022)

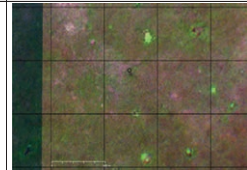
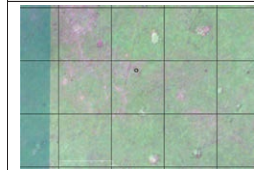


NICFI Planet Basemap

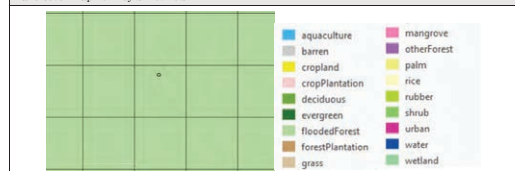
R,G,B=3,2,1 (Red, Green, Blue)

End of rain season (October to December 2021)

Dry season (January to March 2022)



Land cover map 2022 by SERVIR SEA



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【Satellite image interpretation card】

Land use/cover type : Rubber

Forest inventory information:

|                                |  |
|--------------------------------|--|
| Cluster number                 |  |
| Plot number                    |  |
| UTM Easting (Zone 48N)         |  |
| UTM Northing (Zone 48N)        |  |
| Land use/cover type            |  |
| Disturbance                    |  |
| Tree canopy density (%)        |  |
| Above ground biomass (ton/ha)  |  |
| Date of inventory (dd/mm/yyyy) |  |

Satellite image interpretation Key

【ESRI Satellite Image】

Color/Tone: Dark green  
Texture: The canopies of the same size appear granular and look like a carpet.

【Landsat 8/9】

Color/Tone: Overall light yellow-green

【Sentinel-2】

Color/Tone: Light yellow-green  
Texture: The edges of the canopy are not distinct, but there is a slight unevenness, giving an overall carpet-like appearance.

【NICFI Planet Basemap】

Color/Tone : Dark green  
Texture: The edges of the canopy are not distinct, but there is a slight unevenness, giving an overall carpet-like appearance.

ESRI Satellite Image



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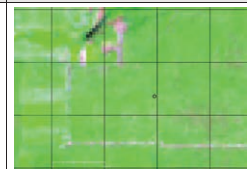
【Satellite image interpretation card】

Landsat 8/9

R,G,B=7,5,4 (SWIR 2, NIR, Red)

End of rain season (October to December 2021)

Dry season (January to March 2022)

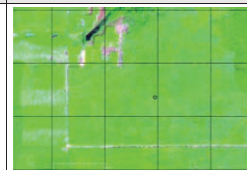
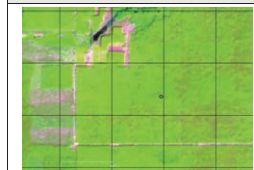


Sentinel-2

R,G,B=12,8,4 (SWIR 2, NIR, Red)

End of rain season (October to December 2021)

Dry season (January to March 2022)

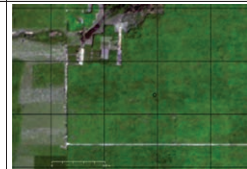
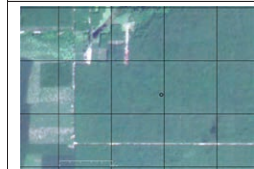


NICFI Planet Basemap

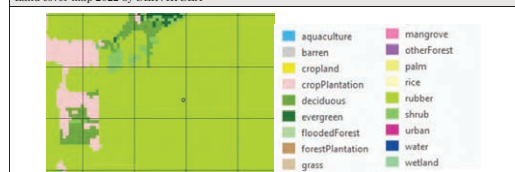
R,G,B=3,2,1 (Red, Green, Blue)

End of rain season (October to December 2021)

Dry season (January to March 2022)



Land cover map 2022 by SERVIR SEA



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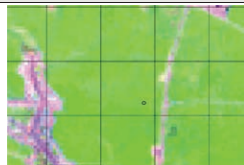
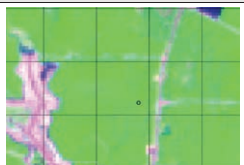
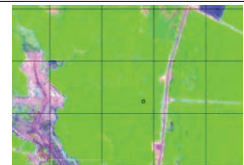
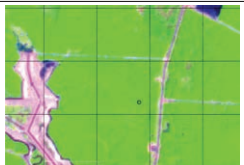
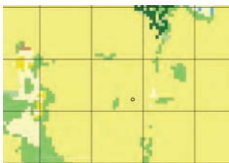
{Satellite image interpretation card}

Land use/cover type : Palm

| Forest inventory information:      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cluster number                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Plot number                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| UTM Easting (Zone 48N)             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| UTM Northing (Zone 48N)            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Land use/cover type                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Disturbance                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Tree canopy density (%)            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Above ground biomass (ton/ha)      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Date of inventory (dd/mm/yyyy)     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Satellite image interpretation Key | <p>ESRI Satellite Image</p>  <p><b>[ESRI Satellite Image]</b><br/> Color/Tone: Dark green<br/> Texture: Canopies of uniform size appear granular and spike-like.</p> <p><b>[Landsat 8/9]</b><br/> Color/Tone: Bright yellow-green</p> <p><b>[Sentinel-2]</b><br/> Color/Tone: Bright yellow-green<br/> Texture: The edges of the canopy are not discernible and it appears flat.</p> <p><b>[NICFI Planet Basemap]</b><br/> Color/Tone : Dark green<br/> Texture: The edges of the canopy are not distinct, but there is an unevenness, giving an overall carpet-like appearance.</p> |

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{Satellite image interpretation card}

| Landsat 8/9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                     | R,G,B=7,5,4 (SWIR 2, NIR, Red)  |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------|-------------|----------|--------|-------------|----------|------|----------------|------|-----------|--------|-----------|-------|---------------|-------|------------------|-------|-------|---------|
| End of rain season (October to December 2021)                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Dry season (January to March 2022)                                                  |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| Sentinel-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                     | R,G,B=12,8,4 (SWIR 2, NIR, Red) |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| End of rain season (October to December 2021)                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Dry season (January to March 2022)                                                  |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| NICFI Planet Basemap                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                     | R,G,B=3,2,1 (Red, Green, Blue)  |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| End of rain season (October to December 2021)                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Dry season (January to March 2022)                                                  |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| Land cover map 2022 by SERVIR SEA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                     |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| <div><table><tr><td>aquaculture</td><td>mangrove</td></tr><tr><td>barren</td><td>otherForest</td></tr><tr><td>cropland</td><td>palm</td></tr><tr><td>cropPlantation</td><td>rice</td></tr><tr><td>deciduous</td><td>rubber</td></tr><tr><td>evergreen</td><td>shrub</td></tr><tr><td>floodedForest</td><td>urban</td></tr><tr><td>forestPlantation</td><td>water</td></tr><tr><td>grass</td><td>wetland</td></tr></table></div> |                                                                                     |                                 | aquaculture | mangrove | barren | otherForest | cropland | palm | cropPlantation | rice | deciduous | rubber | evergreen | shrub | floodedForest | urban | forestPlantation | water | grass | wetland |
| aquaculture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | mangrove                                                                            |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| barren                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | otherForest                                                                         |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| cropland                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | palm                                                                                |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| cropPlantation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | rice                                                                                |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| deciduous                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | rubber                                                                              |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| evergreen                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | shrub                                                                               |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| floodedForest                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | urban                                                                               |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| forestPlantation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | water                                                                               |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |
| grass                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | wetland                                                                             |                                 |             |          |        |             |          |      |                |      |           |        |           |       |               |       |                  |       |       |         |

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## 添付資料 8: 第 1 回技術セミナー発表資料



THE 1<sup>ST</sup> TECHNICAL SEMINAR  
ON THE CAPACITY DEVELOPMENT FOR SUSTAINABLE NATURAL RESOURCE MANAGEMENT

## OUTLINE OF THE SNRM PROJECT

GOSEKI KAZUHIRO (CHIEF ADVISOR)

kazuhiro\_goseki@nhr.nifty.com

29 JUN. 2022, PHNOM PENH & STUNG TRENG, CAMBODIA

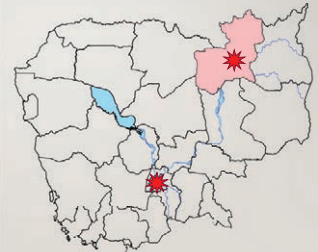
## PROJECT LOCATION

Component 1:

Policy support in Phnom  
Penh

Component 2:

Sub-national  
implementation in Stung  
Tren Province



## SNRM: THE PROJECT FOR NATIONAL AND SUB-NATIONAL CAPACITY DEVELOPMENT FOR SUSTAINABLE RESOURCE MANAGEMENT

- **Overall Goal:**  
Deforestation and forest degradation are reduced through formulation and implementation of related policies and key measures for strengthening protected area management (PAM) and sustainable forest management (SFM).
- **Project Purpose:**  
The national and sub-national government staff in charge of PAM and SFM is equipped with necessary skills and knowledge for sustainable natural resource management.
- **Outputs:**
  - Formulation and implementation of related policies and key measures on PAM/SFM is promoted. (1-1, 1-2)
  - The Action and Investment Plan (AIP) for the Implementation of the National REDD+ Strategy is promoted. (1-3)
  - Provincial staff's capacity for promoting PAM and SFM is enhanced. (2-1)
  - Local communities' capacity for sustainable natural resource management in the selected Community Forestry (CF) and provincial rangers' capacity for supporting local communities' sustainable natural resource management in Community Protected Areas (CPAs) are enhanced. (2-2)

## OTHER INFORMATION OF THE PROJECT

- **JICA Experts**
  - Chief advisor / Forest Policy: Mr. GOSEKI Kazuhiro
  - Coordinator / Capacity development: Mr. MACHIDA Ryohta
  - Consultant team: Forest monitoring experts team headed by Mr. FURUYA Toru
- **Record of Discussions**
  - Signed 18 Mar. 2020 among JICA – MOE (H.E. Sao Sopheap) – MAFF (H.E. Ung Sam Ath)
- **Project Management Unit**
  - Co-Chairpersons of Joint Coordinating Committee: H.E. Kim Nong (DG, GDNPA/MoE) & H.E. Keo Omaliss (DG, FA)
  - Co-Project Directors: Dr. Srey Sunleang (DDG, GDNPA/MoE) & Mr. Chan Ponika (DDG, FA)
  - Co-Project Managers: Mr. Sou Sontara (DD, DILE/GDNPA/MoE) & Mr. Long Ratanakoma (DD, DFC/FA)
  - Component 1 (Policy Support): 14 members of MoE (GDNPA, GDLC, GDEKI) & 4 members of FA
  - Component 2 (Subnational Implementation): 5 members (DoE) & 6 members (DoA/FAC) in Stung Treng Province
- **Project Duration:**  
3years (Oct. 2020 – Oct. 2023)

## PROJECT ACTIVITIES: COMPONENT 1: POLICY SUPPORT (1-1)

1-1-1: Assist in promoting the Action Plan for Implementing the National Protected Area Strategic Management Plan (NPASMP).

1-1-2: Assist in enhancing the capacity of National and Subnational staffs to implement the activities based on the Technical Guideline for Developing Management Plan for Protected Areas.

1-1-3: Assist in addressing emerging issues on the National PAM.



## PROJECT ACTIVITIES: COMPONENT 1: POLICY SUPPORT (1-2)

1-2-1: Assist in promoting the Production Forest Strategic Plan (PFSP) (under drafting).

1-2-2: Assist in addressing emerging issues on the SFM.



## PROJECT ACTIVITIES: COMPONENT 1: POLICY SUPPORT (1-3)

1-3-1: Assist in **promoting AIP**.

1-3-2: Assist in **enhancing the National Forest Monitoring System (NFMS)**.

1-3-3: Assist in **promoting JCM-REDD+**.



## PROJECT ACTIVITIES: COMPONENT 2: SUB-NATIONAL IMPLEMENTATION (2-1 & 2)

2-1-1: **Develop and implement training plans for capacity enhancement of provincial staff.**

2-2-1: **Select one pilot CF.**

2-2-2: **Conduct activities in the selected CF.**

2-2-3: **Develop and implement training plans for capacity enhancement of provincial ranger.**



THANK YOU FOR YOUR ATTENTIONS!

Visit our web-site!

<https://www.jica.go.jp/project/english/cambodia/031/index.html>

To conserve the natural environment, which is the foundations of human existence, JICA provides cooperation on nature conservation in the following three areas, with the aim of facilitating harmony between the conservation of the natural environment and human activities, while contributing particularly toward attaining SDGs 13, 14 and 15:

1. Climate Change Measures through Sustainable Forestry Management and Ecosystems Conservation
2. Sustainable Use of Natural Resources to Improve Livelihoods of Vulnerable Communities
3. Conservation of Biodiversity through Management of Protected Areas and Buffer Zones



## Results of the Forest Inventory in Stung Treng Province

Royal University of Agriculture (RUA) and  
The Project for National and Sub-national Capacity Development for Sustainable Natural Resource Management in Cambodia (SNRM)  
2022/06/29



ASIA AIR SURVEY CO., LTD.

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## Today's Presentation

- Report about the forest inventory and its results
- Recommendation of NFI modification:  
*Sampling number of NFI could be smaller than current NFI setting*
- Provide ideas for the discussion session in the afternoon

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## Contents of presentation

- Background of this Forest Inventory
- Main findings
  - 1) Field survey report
  - 2) Result of forest inventory
  - 3) Recommendation
- Future work

3



## Background of this Forest Inventory

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## Background of this Forest Inventory

### Objective

One of the SNRM project activities is to **assist NFMS** and this inventory was implemented under the activity.

This project activity aims to :

- share the data and the experience with the relevant stakeholders
- contribute the future **National Forest Inventory (NFI)** plan.

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## Background of this Forest Inventory

### Framework and Requirement of NFI

- ❑ In National Forest Monitoring System of Cambodia (2015),

NFI was decided as :

- Implement in 4- 5 years interval
- Permanent Sampling Plots distributed in forested areas by stratified systematic method to set the sampling point by 6x6km (Upland), 4x4 km (Wetland), 1x1km (1<sup>st</sup> Phase Mangrove)

- ❑ NFI data is **crucial source** to set the National FRL

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## Background of this Forest Inventory

### Existing Forest Inventory Data in Cambodia : Project scale only

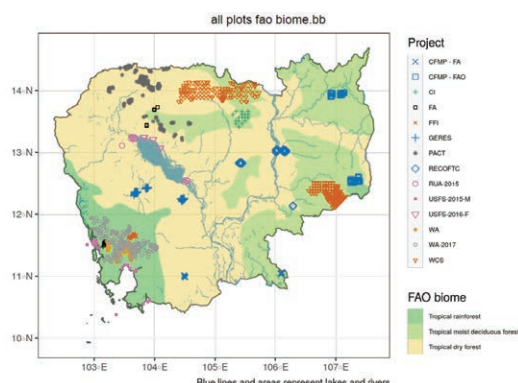


Figure Plot locations with FAO biome. (2019 FAO)

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## 1.Field Survey Report

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## 1.1 Method

### References follwed

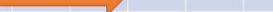
- NFMS document (2015)
- FRL report (2018, 2022)
- Field Manual for the NFI of Cambodia 2018 (FAO, 2018)
- Others
  - 2006 IPCC Guidelines for National Greenhouse Gas Inventories
  - Global Wood Density (GDW) Database
  - REDD+ Cookbook (FFPRI 2016)
  - Peer-reviewed academic articles

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## 1.1 Method

## Task and Timeline of the inventory

| Year                                           | 2021                                                                              |     |     |     | 2022                                                                              |     |                          |     |                         |                   |
|------------------------------------------------|-----------------------------------------------------------------------------------|-----|-----|-----|-----------------------------------------------------------------------------------|-----|--------------------------|-----|-------------------------|-------------------|
| Month                                          | Mar-Sep                                                                           | Oct | Nov | Dec | Jan                                                                               | Feb | Mar                      | Apr | May                     | Jun               |
| Preparation and pre-inventory                  |  |     |     |     |                                                                                   |     |                          |     |                         |                   |
| Field survey                                   |                                                                                   |     |     |     |  |     |                          |     |                         |                   |
| Data entry, Report making and Biomass analysis |                                                                                   |     |     |     |  |     |                          |     |                         |                   |
| Report                                         |                                                                                   |     |     |     |                                                                                   |     | ▲<br>Field survey report |     | ▲<br>Draft final report | ▲<br>Final report |

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### 1.1 Method: Outline of forest inventory

| Items                    | Contents                                                                                                                                                                                                                                                                                                                                          |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Outline</b>        |                                                                                                                                                                                                                                                                                                                                                   |
| Number of survey cluster | <b>120 clusters</b>                                                                                                                                                                                                                                                                                                                               |
| Number of survey points  | <b>360 plots</b>                                                                                                                                                                                                                                                                                                                                  |
| Survey period            | Field: Nov 2021 –Feb 2022    Data entry, Report making and Biomass analysis: Feb-Jun 2022                                                                                                                                                                                                                                                         |
| Survey team              | 5 teams, one team is composed of five persons.<br>1 team conduct one cluster (= 3 plots) per day.                                                                                                                                                                                                                                                 |
| Target area              | Stung Treng Province                                                                                                                                                                                                                                                                                                                              |
| <b>2. Survey methods</b> |                                                                                                                                                                                                                                                                                                                                                   |
| Target biomass           | <b>AGB, BGB, Deadwood, Litter and Soil</b>                                                                                                                                                                                                                                                                                                        |
| Measurement              | Upper part of trees: DBH, Height, Species, Crown density<br>Dead wood: Length, diameter at both sides of wood<br>Soil & Litter: Bring to Phnom Penh                                                                                                                                                                                               |
| Biomass analysis         | For the measurement of AGB and BGB, use the existing equation.<br>For the measurement of dead wood, also use the existing equation.<br>The litter measures the raw weight immediately after collection, dries it in a dryer, and measures the dry weight.<br>For soil, measure the amount of carbon and nitrogen using a CN analyzer or the like. |
| Report                   | Data entry into the excel sheet to analyze, and develop a field report                                                                                                                                                                                                                                                                            |



### 1.1 Method Sampling Design of NFI in NFMS

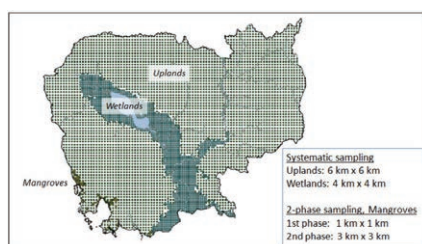


Figure 1. Three strata and cluster design (FAO, NFI manual)

Table 3 Number of PSP for each stratum (NFMS)

| Stratum  | Area (km <sup>2</sup> ) | Number of sampling plot (clusters) expected in forest or other wood land (2 <sup>nd</sup> Phase) |
|----------|-------------------------|--------------------------------------------------------------------------------------------------|
| Uplands  | 152,751.3               | 4,263                                                                                            |
| Wetlands | 27,742.0                | 1,735                                                                                            |
| Mangrove | 1,207.6                 | 146                                                                                              |
| Total    | 181,701.0               | 6,144                                                                                            |



## 1.1 Method

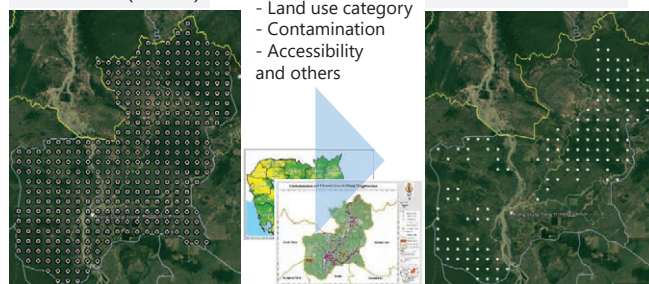
NFI (NFMS) setting  
337 Cluster (6x6km)

Reduced numbers  
due to:

- Land use category
- Contamination
- Accessibility

and others

SNRM project  
120 Cluster selected



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### 1.1 Method

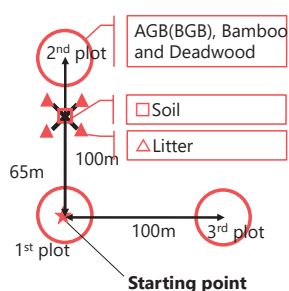
## Summary of field survey

| Item for measure                | Cluster                                        |            |           |           |           | Outside | Note |                                                        |
|---------------------------------|------------------------------------------------|------------|-----------|-----------|-----------|---------|------|--------------------------------------------------------|
|                                 | Plot                                           |            |           |           |           |         |      |                                                        |
|                                 |                                                | R1         | R2        | R3        | R4        |         |      |                                                        |
|                                 | 21.85<br>m                                     | 11.97<br>m | 5.64<br>m | 2.82<br>m | 1.13<br>m |         |      |                                                        |
| Tree                            | DBH<=1cm<br>or no DBH                          | -          | -         | -         | -         | F4A     | -    | A. Seedlings<br>B. Small shrubs and<br>Climbers/Lianas |
|                                 | Saplings:<br>1cm<=DBH<5cm<br>Shrubs :DBH>= 5cm | -          | -         | -         | F4B       | -       | -    | C. Saplings<br>D. Shrubs and<br>Climbers/Lianas        |
|                                 | DBH>= 5cm                                      | -          | -         | F5        | -         | -       | -    |                                                        |
|                                 | DBH>=15cm                                      | -          | F5        | F5        | -         | -       | -    |                                                        |
|                                 | DBH>=30cm                                      | F5         | F5        | F5        | -         | -       | -    |                                                        |
| Dead wood (lying) and<br>Stumps | -                                              | F6         | -         | -         | -         | -       | -    |                                                        |
| Bamboo                          | -                                              | F7         | -         | -         | -         | -       | -    |                                                        |
| Soil sampling                   | -                                              | -          | -         | -         | -         | -       | F8   |                                                        |
| Litter sampling                 | -                                              | -          | -         | -         | -         | -       | F9   |                                                        |

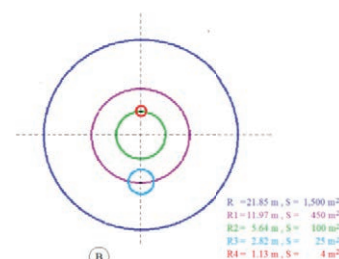


### 1.1 Method

## Cluster design



## Plot design



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## 1.2 Field Survey Report

### Pre-inventory survey in Stung Treng (OJT for surveyors)

Date : January 12 (on-site), 13 (meeting), 2022  
 Venue : Cluster 67081, Stung Treng  
 Participants : 19 persons (MoE, FA, RUA and SNRM)



## 1.2 Field Survey Report

### Field survey in Stung Treng

Date : January 14- February 22, March 26-31, 2022 (48 working days)  
 Venue : 120 Clusters in Stung Treng  
 Participants: 36 persons / 5 groups (including locals and rangers)



## 1.2 Field Survey Report (RUA)

### Forest types and locations of clusters

| 120 Cluster : 360 plots |                       |                     |  |
|-------------------------|-----------------------|---------------------|--|
| Forest Type             | # Implementation Plot | # Inaccessible Plot |  |
| Evergreen forest        | 117                   | 11                  |  |
| Semi-evergreen forest   | 90                    | 10                  |  |
| Deciduous forest        | 110                   | 0                   |  |
| Other                   | 43                    | 3                   |  |
| Total                   | 360                   | 24                  |  |

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## 1.2 Field Survey Report Challenges



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## 1.2 Field Survey Report Challenges

- Difficult to find/reach the target clusters:** Some clusters were hard to find due to poor conditions of the roads and others were located in physically difficult places to reach.
- Physically hard environment:** There were dangers to encounter illegal loggers, pests, snakes, and other dangerous wildlife
- Communication difficulties:** low signal for cell phones and limited distance to connect with transceivers made the communication among survey teams hard.
- Camp sites location:** the camp sites were usually located near the water sources (e.g. canal or stream). They were sometimes very far from the target clusters and made the daily travel long
- Maintenance of motorcycles:** due to the poor road conditions, motorcycles were broken frequently
- Transportation of necessities:** it was hard to transport all the survey equipment, material, **batteries, fuel, and foods** to some clusters far from towns.

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## 1.2 Field Survey Report Crucial points for smooth implementation

- Capacity building of survey team
- Good networking with local guide and forest rangers
- Strong coordination from the MoE, particularly the facilitation of DoE, PDAFF, FA to CPAs and CFs
- Participation at all levels, particularly local authorities always collaborated with the team to work in their areas where the clusters located in.
- Leadership in teamwork to achieve the assigned tasks and collaboration by team members
- Preparation with maps included Google Earth maps, CF map, and CPA map.

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## 2. Results of Forest Inventory

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## 2. Result of Forest Inventory

Calculated results of each carbon pool (Ct/ha)

| Forest Type           | ABG* (Ct/ha) | BGB* (Ct/ha) | Deadwood (Ct/ha) | Litter (Ct/ha) | Soil (Ct/ha) | Total (Ct/ha) | Total CO <sub>2</sub> (t/ha) |
|-----------------------|--------------|--------------|------------------|----------------|--------------|---------------|------------------------------|
| Evergreen forest      | 115.36       | 42.59        | 3.19             | 1.74           | 68.49        | 231.37        | 848.36                       |
| Semi-evergreen forest | 71.76        | 14.35        | 5.05             | 0.94           | 63.77        | 155.87        | 571.52                       |
| Deciduous forest      | 38.48        | 7.70         | 5.44             | 1.04           | 65.24        | 117.90        | 432.30                       |
| Other                 | 4.74         | 0.95         | 1.45             | 1.28           | 61.30        | 69.72         | 255.64                       |

\*Standing tree and bamboo

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## 2. Result of Forest Inventory

Comparison between forest inventory in Stung Treng and national FRL

ST

| Forest Type           | #Plot | ABG    | BGB   | (RS)                | Total Biomass | Total Carbon | Total CO <sub>2</sub> | e% (95%CI) |
|-----------------------|-------|--------|-------|---------------------|---------------|--------------|-----------------------|------------|
| Evergreen forest      | 117   | 245.46 | 90.61 | 0.37(0.20 (Bamboo)) | 336.07        | 157.95       | 579.16                | 12%        |
| Semi-evergreen forest | 90    | 152.67 | 30.53 | 0.20                | 183.20        | 86.11        | 315.72                | 13%        |
| Deciduous forest      | 110   | 81.86  | 16.37 | 0.20                | 98.24         | 46.17        | 169.30                | 13%        |
| Other                 | 43    | 10.08  | 2.02  | 0.20                | 75.92         | 35.68        | 130.84                | 103 -196%  |

FRL

| Forest Type           | #Plot | ABG    | BGB   | (RS)                | Total Biomass | Total Carbon | Total CO <sub>2</sub> e | (CI) |
|-----------------------|-------|--------|-------|---------------------|---------------|--------------|-------------------------|------|
| Evergreen forest      | 446   | 133.12 | 49.26 | 0.37                | 182.38        | 85.72        | 314.30                  | 5%   |
| Semi-evergreen forest | 49    | 165.23 | 33.05 | 0.20                | 198.28        | 93.19        | 341.70                  | 19%  |
| Deciduous forest      | 132   | 70.87  | 14.17 | 0.20                | 85.04         | 39.97        | 146.55                  | 10%  |
| Other Forest          | 54    | 73.03  | 14.85 | 0.20(0.49 Mangrove) | 87.88         | 41.30        | 151.43                  | 0%   |

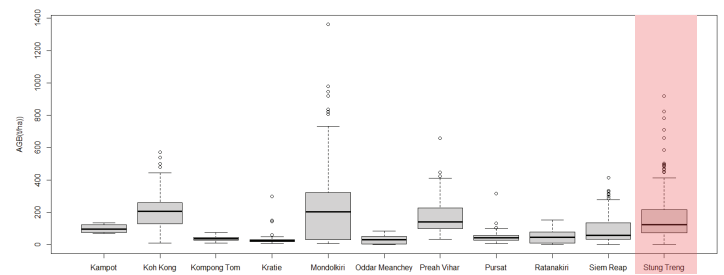
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## 2. Result of Forest Inventory

Results of all AGB data(ton/ha)

Stung Treng's forests are relatively dense

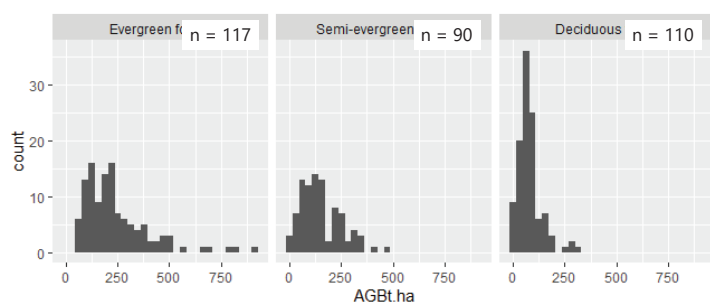


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## 2. Result of Forest Inventory

Result of AGB per plot (t/ha) for each Forest Type

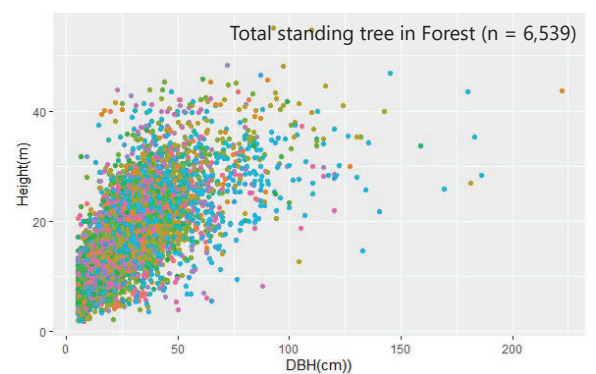


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## 2. Result of Forest Inventory

Relationship between tree height and DBH



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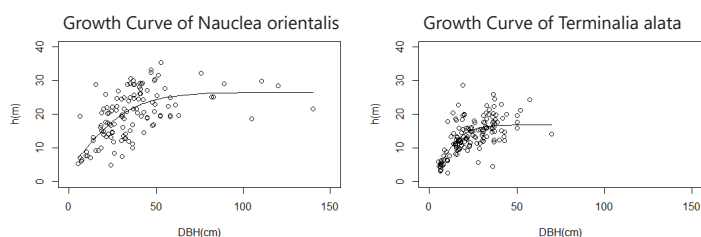


## 2. Result of Forest Inventory

### Modeling height-diameter curves for prediction

Gompertz :  $H = A \exp(-b \exp(-ct))$

The data is useful for development of species specific allometric equation.



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## 3. Recommendation

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## 3. Conclusion and Recommendation

- ❑ The NFI field manual lacks some details of survey methods
  - Improve the NFI field manuals (ex. including methods to measure deserted part of illegally cut timbers)
- ❑ The results of AGB for each forest type shows different trend from FRL data
  - Same type of all wide scale inventory is needed to improve the quality of FRL
- ❑ This inventory results is the first kind of sub-national scale random sampling data which has a tremendous scientific value.
  - The data can be available for academic studies
- ❑ This result of forest inventory is useful for GHG inventory in Cambodia.
  - The results can contribute to improve the national GHG inventory and BUR

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## Future Work (Discussion)

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## 6. Future Work (Today's Discussion)

NFMS: Required sampling number of plot in Stung Treng

| Forest Type           | #Plot | Sum      | Ave.     | SD       | SE       | E        | E. % | Coefficient of variation (SD/Ave.) | Required sampling No. (10%) |
|-----------------------|-------|----------|----------|----------|----------|----------|------|------------------------------------|-----------------------------|
| Evergreen forest      | 117   | 28576.64 | 244.2448 | 161.9126 | 14.96882 | 29.33889 | 12%  | 0.662911005                        | 169                         |
| Semi-evergreen forest | 90    | 13599.57 | 151.1063 | 98.10353 | 10.34102 | 20.2684  | 13%  | 0.649235243                        | 162                         |
| Deciduous forest      | 110   | 8937.046 | 81.24588 | 58.95815 | 5.621439 | 11.01802 | 14%  | 0.725675586                        | 202                         |
|                       | 317   | 51113.25 |          |          |          |          |      |                                    | 533                         |

The forest inventory result in Stung Treng: 120 Clusters 360plots / Around 32,500USD

Option1 NFI : 6x6 km grid setting

➢ 337 Clusters 1,011 plots / Around 92,000 USD

Option2 Required sampling number based on the forest inventory result

➢ 178 Clusters 533 plots / Around 48,000 USD

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## Other potential applications

The inventory result can contribute to sustainable natural resource management of Cambodia

### EF and FRL : Improvement of FRL setting

- ❑ Results of tree data (height and DBH) can contribute to the development of allometric equations
- ❑ Results of deadwood, litter and soil can contribute to the establishment of EF in FRL setting

### Others

- ❑ Experiences can be used for community forest management

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## Purpose of this presentation

- ✓ Reporting the **progress** of drone training for the Central government
- ✓ Presenting the **plan of next** drone trainings for the Central/Stung Treng provincial governments
- ✓ Introducing the **potential usages** of drone (for the discussion session)

2



## Contents

1. Outline of drone training for Central / Stung Treng Provincial governments
2. Progress of the training
3. Next steps of the training

3



## 1. Outline of drone training for Central / Stung Treng Provincial governments

4



## Outline of Drone Training

### Goal

To enhance the capacity of forest monitoring and management through the utilization of drone.

### Main roles for forest monitoring and management

#### Central government (MoE and FA)

National land use/cover (LULC) and forest cover mapping, demarcation and zoning of forest areas of the entire country.

#### Provincial government (Stung Treng DoE and FAC)

Monitoring of illegal logging and forest encroachment by patrolling.

5



## Expected outcome of the training

### Central government (MoE and FA) :

Able to use fixed wing drone (eBee Geo) and make a wide area precise map

### Provincial government (Stung Treng DoE and FAC) :

Able to use multi-copter drone (Mavic or Phantom4) to collect a variety of evidence for forest patrolling

6

6



## Difference of two types of drone

|                   | For Central Gov.<br>Fixed-wing UAV<br>(eBee Geo)                                                                                                                                                                                                          | For Stung Treng Prov. Gov.<br>Multi-copter UAV<br>(Mavic 3 or Phantom 4 Pro)                                                                                                                   |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Specification     |                                                                                                                                                                                                                                                           |                                                                                                                                                                                                |
| Max. flight time  | 45 minutes                                                                                                                                                                                                                                                | 30 to 46 minutes                                                                                                                                                                               |
| Covering Area     | 160ha at 160m altitude                                                                                                                                                                                                                                    | 45ha at 150m altitude                                                                                                                                                                          |
| Max. flight range | ~30km                                                                                                                                                                                                                                                     | ~8km                                                                                                                                                                                           |
| Approx. accuracy  | Down to 3 cm (with GCP and GeoBase)                                                                                                                                                                                                                       | Horizontal: 30cm<br>Vertical: 10cm                                                                                                                                                             |
| Advantage         | <ul style="list-style-type: none"> <li>• Long flight time<br/>⇒ Capable to capture wide area<br/>⇒ Capable to fly far area</li> <li>• High accuracy with GeoBase<br/>⇒ Good for wide area precise mapping</li> <li>• Strong for wind (12.8m/s)</li> </ul> | <ul style="list-style-type: none"> <li>• Easy operation (no need big open area for take-off and landing, simple equipment setting)<br/>⇒ It can take-off and land inside the forest</li> </ul> |
| Weakness          | <ul style="list-style-type: none"> <li>• Need open area for take-off and landing</li> <li>• Taking time for setting up base camp and drone</li> </ul>                                                                                                     | <ul style="list-style-type: none"> <li>• Need manual operation skill</li> <li>• Weak for wind (10 m/s)</li> </ul>                                                                              |

7



## Training Schedule

### Timeline

|                                        | Q2 2022        | Q3 2022 | Q4 2022            | Q1 2023            | Q2 2023 | Q3 2023 |
|----------------------------------------|----------------|---------|--------------------|--------------------|---------|---------|
| Central Gov. (MoE, FA)                 | Drone Training |         | Drone OJT training |                    |         |         |
| Stung Treng Provincial Gov. (DoE, FAC) |                |         | Drone Training     | Drone OJT training |         |         |

8



## 2. Progress of the training (Basic operation and OJT)

9



## Progress of the training (Basic)

### Purpose

The participants learn the basic of eBee operation and aerial photo processing using Pix4D software.

### Training period

MoE : April 20-21 (eBee operation)

FA : April 26-27 (eBee operation),  
May 4 (Aerial photo processing)

### Place

Stung Treng Province  
MoE: Prey Lang PA  
FA : Sesan District



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## Progress of the training (Basic)

### Training contents

- Drone Applications Classroom Lecture
- Setting of drone equipment (eBee Geo and GeoBase)
- Flight planning, operation, and flight simulation (eMotion Software)
- Setting of base camp and drone equipment Field training
- Flight planning\*
- Practice for Take-off and Landing
- Data download
- Aerial photo processing (Pix4D software) Classroom Lecture

\* In flight planning, the participants learned to adopt the appropriate flight settings such as flying heights, areas, and distances to meet their various needs

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## Progress of the training (Basic)

### Training for MoE



Classroom lecture



Setting of base camp and drone equipment



Geo Base (GNSS) setting on a benchmark



Take-off and landing



Flight planning

12



## Progress of the training (Basic)

### Training for FA



Classroom Lecture



Setting of base camp



Take-off and landing



Flight planning

13



## Progress of the training (Basic)

### Training of aerial photo processing using Pix4D software



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## Progress of the training (OJT)

### Outline of OJT

- 1) Operate fixed wing drone in community forestry (CF) area managed by FA
- 2) Conduct aerial photo processing
- 3) Make a base map of CF to support community forestry activities (such as boundary demarcation of CF).

### Training period

FA : June 14 – 16 (for drone operation)

### Place and area

Phnom Takong CF in Stung Treng Province (1,112.5ha)



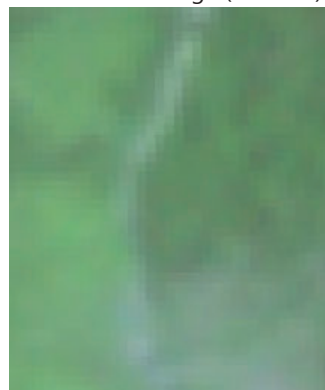
## Progress of the training (OJT)

Ground Sampling Distance (GSD): 7cm



## Comparison of Drone photo and Satellite image

5m satellite image (PLANET)



7cm drone photo



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## Progress of the training (OJT)

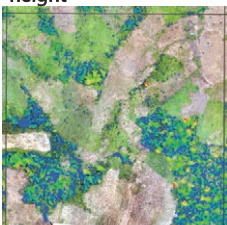
By processing drone aerial photos from this OJT, the following three types of data were produced.

Orthomosaic image and Contour



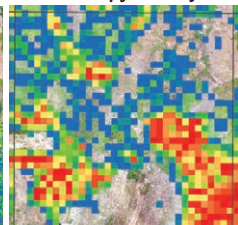
Contour (5m)

Canopy cover and height



Tree Height (m)  
<VALUE>  
5.19 - 10  
10.1 - 15  
15.1 - 20

Canopy density



Canopy density (%)  
3.01 - 5.00  
5.01 - 10.00  
10.01 - 15.00  
15.01 - 20.00  
20.01 - 25.00  
25.01 - 30.00  
30.01 - 35.00  
35.01 - 40.00  
40.01 - 45.00  
45.01 - 50.00  
50.01 - 55.00  
55.01 - 60.00  
60.01 - 65.00  
65.01 - 70.00  
70.01 - 75.00  
75.01 - 80.00  
80.01 - 85.00  
85.01 - 90.00  
90.01 - 95.00  
95.01 - 100.00

18



## Progress of the training (OJT)

Base map was created using the OJT data for Phnom Takong CF to support community forestry activities such as boundary demarcation

Phnom Takong CF Map



## 3. Next steps of the training

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## Next Steps (short term)

### MoE and FA

Continue conducting OJT (~Q1 2023)

### Stung Treng DoE and FAC

Conduct basic training and OJT  
(Q3 2022 – Q3 2023)

21



## Next Steps (short term): Collaboration with CEMIS

- ❖ Through OJT, central government learns how to operate drone and process the drone data to be incorporated into **CEMIS** (Cambodia Environment Management Information System)
- ❖ CEMIS plans to develop an **internal function** to store, manage, and share the drone data

22



## Next Steps (long term)

### Recommendations of drone application

- Create or update LULC map and forest cover map
- Monitor illegal logging and forest encroachment
- Boundary demarcation for protected areas (PAs) and production forests
- Zoning of PAs
- Land use planning
- Understand forest condition such as canopy cover, canopy height and canopy density

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Thank you  
for your attention!

## 添付資料 9: 第 2 回技術セミナー発表資料





SNRM: THE PROJECT FOR NATIONAL AND SUB-NATIONAL CAPACITY DEVELOPMENT FOR SUSTAINABLE RESOURCE MANAGEMENT



# OUTLINE OF SNRM PROJECT

GOSEKI KAZUHIRO (FORMER CHIEF ADVISOR)

kazuhiro\_goseki@mnr.nifty.com

AUGUST 2024, PHNOM PENH AND STUNG TRENG, CAMBODIA



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## PROJECT LOCATION

Component 1:

Policy support in Phnom Penh

Component 2:

Sub-national implementation in Stung Treng Province



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## SNRM: THE PROJECT FOR NATIONAL AND SUB-NATIONAL CAPACITY DEVELOPMENT FOR SUSTAINABLE RESOURCE MANAGEMENT

- Overall Goal:  
Deforestation and forest degradation are reduced through formulation and implementation of related policies and key measures for strengthening protected area management (PAM) and sustainable forest management (SFM).
- Project Purpose:  
The national and sub-national government staff in charge of PAM and SFM is equipped with necessary skills and knowledge for sustainable natural resource management.
- Outputs:
  - Formulation and implementation of related policies and key measures on PAM/SFM is promoted. (1-1, 1-2)
  - The Action and Investment Plan (AIP) for the Implementation of the National REDD+ Strategy is promoted. (1-3)
  - Provincial staff's capacity for promoting PAM and SFM is enhanced. (2-1)
  - Local communities' capacity for sustainable natural resource management in the selected Community Forestry (CF) and provincial rangers' capacity for supporting local communities' sustainable natural resource management in Community Protected Areas (CPAs) are enhanced. (2-2)

4

## OTHER INFORMATION OF THE PROJECT

- JICA Experts
  - Chief advisor / Forest Policy: Mr. GOSEKI Kazuhiro
  - Coordinator / Capacity development: Mr. IYAMA Kazuo and Mr. MACHIDA Ryohta
  - Consultant team: Forest monitoring experts team headed by Mr. FURUYA Toru
- Record of Discussions
  - Signed 18 Mar. 2020 among JICA – MOE (H.E. Sao Sopheap) – MAFF (H.E. Ung Sam Ath)
- Project Management Unit
  - Co-Chairpersons of Joint Coordinating Committee: H.E. Kim Nong (Under Secretary of State, MoE) & H.E. Keo Omalis (DG, FA)
  - Co-Project Directors: H.E. Dr. Srey Sunleang (DG, GDNPA/MoE) & Mr. Chan Ponika (DDG, FA)
  - Co-Project Managers: Mr. Sou Sontara (DD, DILE/GDNPA/MoE) & Mr. Long Ratanakoma (DD, DFC/FA)
  - Component 1 (Policy Support): 14 members of MoE (GDNPA, GDLC, GDEKI) & 4 members of FA
  - Component 2 (Subnational Implementation): 5 members (DoE) & 6 members (DoA/FAC) in Stung Treng Province
- Project Duration:  
4 years (Oct. 2020 – Oct. 2024) \* main activities were completed by Oct. 2023 and only NFMS related activities are extended to Oct. 2024.

5

## PROJECT ACTIVITIES: COMPONENT 1: POLICY SUPPORT (1-1)

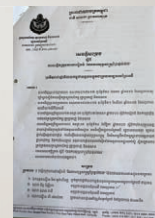
- I-1-1: Assist in promoting the Action Plan for Implementing the National Protected Area Strategic Management Plan (NPASMP).
  - monitoring the progress and compiling the result of the Action Plan, reviewing NPASMP, and making recommendation on implementing NPASMP
- I-1-2: Assist in enhancing the capacity of National and Subnational staffs to implement the activities based on the Technical Guideline for Developing Management Plan for Protected Areas.
  - reviewing the technical documents, and preparing and conducting trainings for Dept. of Freshwater and Wetland, East of Mekong, and North of Tonlesap, as well as related DoE and Protected Area staffs
- I-1-3: Assist in addressing emerging issues on the National PAM.  
(no emerging issues)



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## PROJECT ACTIVITIES: COMPONENT 1: POLICY SUPPORT (1-2)

- I-2-1: Assist in promoting the Production Forest Strategic Plan (PFSP) (under drafting).
  - supporting PFSP WG, but not finalized
- I-2-2: Assist in addressing emerging issues on the SFM.  
(no emerging issues)



## 7 PROJECT ACTIVITIES: COMPONENT 1: POLICY SUPPORT (1-3)

### 1-3-1: Assist in **promoting AIP**.

- exchanging information with RTS

### 1-3-2: Assist in **enhancing the National Forest Monitoring System (NFMS)**.

- operating the NFMS including forest inventory survey in Stung Treng and collaborating with CEMIS, and conducting trainings for MoE and FA on utilizing drone and satellite images to operate NFMS

### 1-3-3: Assist in **promoting JCM-REDD+**.

- communicating with implementing/ interested parties



## 8 PROJECT ACTIVITIES IN THE EXTENDED PROJECT PERIOD (NOV2023-AUG2024) FOR NFMS RELATED ACTIVITIES

### 1-3-2: Assist in **enhancing the National Forest Monitoring System (NFMS)**.

- conducted multi-copter drone training, and basic and intermediate to advanced GIS trainings for MoE GDNPA staffs
- conducted fixed-wing drone OJT training for FA staffs



## 9 PROJECT ACTIVITIES: COMPONENT 2: SUB-NATIONAL IMPLEMENTATION (2-1 & 2)

### 2-1-1: **Develop and implement training plans for capacity enhancement of provincial staff.**

- conducting NFMS related training including drone operation for DoE and FAC

### 2-2-1: **Select one pilot CF.**

- selecting Phnom Takong CF

### 2-2-2: **Conduct activities in the selected CF.**

- preparing, conducting, and monitoring the pilot activities in the CF considering the capacity building of FAC staffs

### 2-2-3: **Develop and implement training plans for capacity enhancement of provincial ranger.**

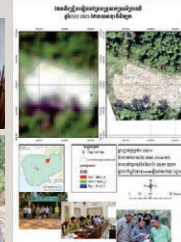
- training the 60 rangers in Stung Treng and supporting 7 CPAs by disseminating their knowledge, including patrolling, AVENZA, First Aid and the New Environment Law



## 10 PROJECT ACTIVITIES IN THE EXTENDED PROJECT PERIOD (NOV2023-AUG2024) FOR CAPACITY ENHANCEMENT OF PROVINCIAL STAFFS

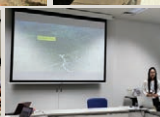
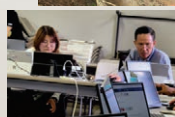
### 2-2-1: **Develop and implement training plans for capacity enhancement of provincial staff.**

- Conducted drone OJT trainings for Stung Treng DoE and FAC staffs.



## Providing Online and In-person Trainings

- Tropical Forest Management Using the JI-FAST and Other Satellite Technologies (2021: 1 person online; 2022: 1 person online)
- Remote Sensing of Forest Resources (2021: 2 persons online)
- Policy Planning Skills for Implementation of REDD+ (for Government Executives) (2021 (JFY2020): 1 person online; 2021 (JFY2021): 1 person online)
- Proceeding Ability of Policy Making for Sustainable Forest Management (2022: 2 persons online; 2023: 1 person online)
- Ecosystem-based Solutions for Disaster Risk Reduction (Eco-DRR) (2022: 1 person online)
- Country Training for The Project for National and Sub-national Capacity Development for Sustainable Natural Resource Management in Cambodia (2023: 6 persons in Japan)
- Remote Sensing of Forest Resources (2024: 4 persons in Japan)



## 12 THANK YOU FOR YOUR ATTENTIONS!

Visit our web-site!

<https://www.jica.go.jp/Resource/project/english/cambodia/031/index.html>



# 1. Process to organize trainings

Output of the Assessment:

Table 1: DoE Response Assessment

| Duty                                                                                                                                                                                                                                                                                                                                                                                                      | Challenges                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Solution                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>Checking data patrolling from rangers (SMART app) then make report</li> <li>Producing Map</li> <li>Mapping illegal logging bug area with drone</li> <li>Managing seven CPs</li> <li>Patrolling</li> <li>Collecting data using SMART</li> <li>Proving Environmental Education to local</li> <li>Making report (criminal record...)</li> </ul> <p><i>For TOT</i></p> | <ul style="list-style-type: none"> <li>Lack capacity of making map (still basic)</li> <li>Lack equipment use to create map</li> <li>Lack capacity in using Drone, only taking picture (planning, processing, ...)</li> <li>Lack budget (e.g. organize workshop...)</li> <li>Drone provided only allow to use in project</li> <li>Data from ranger, sometimes errors</li> <li>Lack capacity of identifying and observing biodiversity (e.g. species...)</li> </ul>      | <ul style="list-style-type: none"> <li>Training about making map (GIS) and acceptable</li> <li>Training about making map integrated satellite, GIS, drone image and RS</li> <li>Training about SMART (desktop and mobile)</li> <li>Training about description of map</li> </ul> |
| <p>Officers, community leaders, Rangers</p> <p>Res: Patrolling, taking pictures, submit data</p> <p><i>For Trainee</i></p>                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>Lack capacity of identifying and observing biodiversity (e.g. species...)</li> <li>Lack equipment for patrolling</li> <li>Lack capacity of producing good picture</li> <li>Lack capacity of writing report</li> <li>Lack capacity of understanding SMART updates</li> <li>Lack capacity of describing map</li> <li>Lack capacity of determining size of the illegal</li> <li>Lack equipment for training or workshop</li> </ul> | <ul style="list-style-type: none"> <li>Training about description of map</li> <li>Training about writing report (e.g. monthly report, criminal record...)</li> <li>Training about identifying age and type of species</li> </ul>                                                |

# 1. Process to organize trainings

Output of the Assessment:

Table 2: FAC Response Assessment

| Duty                                                                                                                                                                                                                                                                                         | Challenges                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Solution                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>FA-C: lead staff, mediation, implementation (indirect), cooperation (NGO, Gov...)</p> <p>FA-D: lead staff, mediation, cooperation (NGO, Gov...), implementation (direct)</p> <p>FA-T: lead staff, mediation, cooperation (NGO, Gov...), implementation (direct)</p> <p><i>For TOT</i></p> | <ul style="list-style-type: none"> <li>Lack capacity of making map</li> <li>Lack capacity of using Drone</li> <li>Lack equipment for office</li> <li>Lack equipment for patrolling</li> <li>Lack equipment for transportation</li> <li>Lack of officer</li> <li>Lack of budget</li> <li>Wildlife illegal hunting</li> <li>Illegal logging</li> <li>Land encroachment</li> <li>It will be better to have drone for patrolling</li> <li>Those who commit crime not afraid law</li> </ul> | <ul style="list-style-type: none"> <li>Training about making map</li> <li>Training about writing report (e.g. monthly report, criminal record...)</li> </ul> |
| <p>Deputy FA-D and Deputy FA-T: similar duties with FA-D and FA-T responsibilities. Officer FA-D and FA-T: patrol and check field when got assigned by department then make report</p> <p><i>For Trainee</i></p>                                                                             | <ul style="list-style-type: none"> <li>Lack capacity of writing report (regarding experiences and less training in previous time)</li> <li>Lack of ability as a judicial police officer</li> </ul>                                                                                                                                                                                                                                                                                     |                                                                                                                                                              |

# 1. Process to organize trainings

Output of the Assessment:

Table 3: GDNPA Response Assessment

| Question                              | Dep. Administration Planning and Finance | Dep. Terrestrial Protected Area Conservation (Eastern Mekong River) | Dep. Terrestrial Protected Area Conservation (North of Tonlesap) | Dep. Terrestrial Protected Area Conservation (South of Tonlesap) | Dep. Fresh Water Wetland Area Conservation | Dep. Inspection and Law Enforcement |
|---------------------------------------|------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------|-------------------------------------|
| 11. Knowledge of GIS software         | Basic                                    | Basic                                                               | Advanced                                                         | Basic                                                            | Advanced                                   | Advanced                            |
| 13. How often do you use GIS software | Monthly                                  | Weekly                                                              | Weekly                                                           | Daily                                                            | Daily                                      | Weekly                              |

# 2. Outline of the trainings

## Objective of the trainings:

The national and sub-national government staff in charge of protected area management and sustainable forest management is equipped with necessary skills and knowledge for sustainable natural resource management.



## Drone

- ❖ Fixed-wing drone training (MoE & FA)  
Operation and data processing with eBee
- ❖ Multi-copter drone training (DOE & FAC)  
Operation and data processing with DJI Phantom 4, DJI Mavic 3, and DJI Mini



## GIS & RS

- ❖ Map utilization training (DOE & FAC)
- ❖ Satellite image processing/ interpretation training (MoE & FA)
- ❖ GIS training: Basic/ Intermediate to Advanced (MoE)
- ❖ Training for data entry and biomass calculation for forest monitoring (MoE & FA)

# 3. Drone trainings (17 times in total)

| Training name                                         | Objective                                                                                                                             | Target organization | Period                                                                                                                                                                                           |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 [Activity 1-3-2] Fixed-wing drone training          | To develop the capacity of national government staffs for the safe and effective forest monitoring by using a fixed-wing drone.       | Central MoE (DGIS)  | - 27 <sup>th</sup> -29 <sup>th</sup> Dec 2021<br>- 20 <sup>th</sup> -21 <sup>st</sup> Apr 2022<br>- 27 <sup>th</sup> Aug 2022                                                                    |
| 2                                                     |                                                                                                                                       | Central FA          | - 27 <sup>th</sup> -29 <sup>th</sup> Dec 2021<br>- 26 <sup>th</sup> -27 <sup>th</sup> Apr 2022<br>- 14 <sup>th</sup> -16 <sup>th</sup> Jun 2022<br>- 17 <sup>th</sup> -20 <sup>th</sup> Apr 2023 |
| 3 [Activity 2-1-1] Multi-copter drone training        | To develop the capacity of sub-national government staffs for the safe and effective forest monitoring by using a multi-copter drone. | Provincial DOE      | - 22 <sup>nd</sup> -24 <sup>th</sup> Aug 2022<br>- 7 <sup>th</sup> -8 <sup>th</sup> Feb 2023<br>- 23 <sup>rd</sup> -30 <sup>th</sup> Mar 2023                                                    |
| 4                                                     |                                                                                                                                       | Provincial FAC      | - 10 <sup>th</sup> -12 <sup>th</sup> Oct 2022<br>- 9 <sup>th</sup> -11 <sup>th</sup> Feb 2023<br>- 22 <sup>nd</sup> -24 <sup>th</sup> Mar 2023                                                   |
| 5 [Activity 1-3-2] Drone and data processing training | To develop the capacity of national government staffs to enhance qualified drone data processing.                                     | Central FA          | - 4 <sup>th</sup> May 2022<br>- 19 <sup>th</sup> Jun 2023                                                                                                                                        |
| 6 [Activity 2-1-1] Follow-up training                 | To follow-up the multi-copter drone training.                                                                                         | Provincial FAC      | - 18 <sup>th</sup> -23 <sup>rd</sup> Jan 2024                                                                                                                                                    |
| 7                                                     |                                                                                                                                       | Provincial DOE      | - 24 <sup>th</sup> -26 <sup>th</sup> Jan 2024                                                                                                                                                    |

# 3. Drone trainings



## Fixed-wing drone training

### Contents

- Operation of Sensefly eBee Geo (Take-off and landing)
- Set up of GeoBase
- Flight planning and simulation
- Data downloading
- Pre-Data processing

### Manuals (Khmer)

- Gdrive-Folder: 1. Fixed-Wing Drone Training
- e-Learning material of fixed-wing drone operation (English subtitle)

Training to DGIS



Training to FA



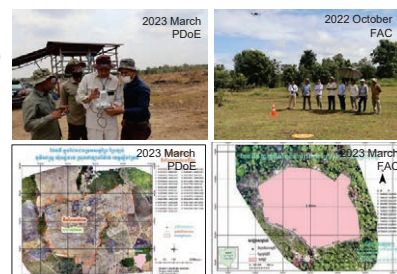
 **Fixed-wing drone training (e-learning training material)**



## Multi-copter drone training

- Manual and automatic operation of multi-copter drones (Phantom 4 and DJI Mavic 3)
- Flight planning and simulation
- Data import
- Data processing

- Gdrive-Folder: 2. Multi-Copter Drone Training



## Drone and data processing training

- Data processing of drone image by using Pix4D and GIS software (creation of quality report, orthophoto creation, overlaying other data, map layout)

- Gdrive-Folder: 2. Multi-Copter Drone Training /JICA SNRM Drone Image Processing Pix4D



**Follow-up training (January 2024)**

- Manual and automatic operation of multi-copter drones (Phantom 4 and DJI Mavic 3)

Same with the previous trainings



In the series of drone trainings, the following capacity has been nurtured according to the needs and technical level of each organization.

|                   | National level                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                    | Sub-national level                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   | MoE (DGIS)                                                                                                                                                                                                                                                                                                         | FA                                                                                                                                                                                                                                                                                                                 | PDoe                                                                                                                                                                                                                                                                                                                                                      | FAC                                                                                                                                                                                                                                                                                                                                                                |
| Gained capacity   | [Handed over equipment]<br>Sensefly eBee Geo                                                                                                                                                                                                                                                                       | [Handed over equipment]<br>Sensefly eBee Geo                                                                                                                                                                                                                                                                       | [Handed over equipment]<br>DJI Phantom 4                                                                                                                                                                                                                                                                                                                  | [Handed over equipment]<br>DJI Mavic 3 and Mini                                                                                                                                                                                                                                                                                                                    |
|                   | <b>[Capacity]</b> <ul style="list-style-type: none"> <li>• Operation of eBee Geo</li> <li>• Data processing               <ul style="list-style-type: none"> <li>– Creation of orthophoto</li> <li>– Layout of created orthophoto</li> <li>– Calculation of area</li> <li>– Quality control</li> </ul> </li> </ul> | <b>[Capacity]</b> <ul style="list-style-type: none"> <li>• Operation of eBee Geo</li> <li>• Data processing               <ul style="list-style-type: none"> <li>– Creation of orthophoto</li> <li>– Layout of created orthophoto</li> <li>– Calculation of area</li> <li>– Quality control</li> </ul> </li> </ul> | <b>[Capacity]</b> <ul style="list-style-type: none"> <li>• Operation of Phantom 4</li> <li>• Data processing               <ul style="list-style-type: none"> <li>– Creation of orthophoto</li> <li>– Layout of created orthophoto</li> <li>– Calculation of area</li> <li>– Quality control</li> </ul> </li> <li>• Import maps to Avenza Maps</li> </ul> | <b>[Capacity]</b> <ul style="list-style-type: none"> <li>• Operation of multi-copter drone</li> <li>• Data processing               <ul style="list-style-type: none"> <li>– Creation of orthophoto</li> <li>– Layout of created orthophoto</li> <li>– Calculation of area</li> <li>– Quality control</li> </ul> </li> <li>• Import maps to Avenza Maps</li> </ul> |
| Contributed works | <ul style="list-style-type: none"> <li>• Detection of LULC change</li> <li>• Map creation and reporting about forest monitoring</li> </ul>                                                                                                                                                                         | <ul style="list-style-type: none"> <li>• Detection of LULC change</li> <li>• Map creation and reporting about forest monitoring</li> </ul>                                                                                                                                                                         | <ul style="list-style-type: none"> <li>• Monitoring of illegal logging</li> <li>• Reporting of patrolling with the latest maps</li> </ul>                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>• Monitoring of illegal logging</li> <li>• Reporting of patrolling with the latest maps</li> </ul>                                                                                                                                                                                                                          |

|   | Training name                                                        | Objective                                                                                                                          | Target organization |             | Period                                                                                                                                                                                   |
|---|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | [Activity 2-1-1]<br>Map utilization training                         | To develop the capacity of sub-national government staffs to use maps for forest monitoring including ground truthing.             | Provincial          | DOE         | - 7 <sup>th</sup> -8 <sup>th</sup> Dec 2022<br>- 19 <sup>th</sup> -20 <sup>th</sup> Dec 2022                                                                                             |
| 2 |                                                                      |                                                                                                                                    | Provincial          | FAC         | - 6 <sup>th</sup> -7 <sup>th</sup> Dec 2022<br>- 21 <sup>st</sup> -22 <sup>nd</sup> Dec 2022<br>- 26 <sup>th</sup> May 2023                                                              |
| 3 | Satellite image processing/ interpretation training                  | To develop the capacity of central and sub-national government staffs on use satellite imagery to identify LULC and its changes    | Central             | MoE         | - 4 <sup>th</sup> -5 <sup>th</sup> Sep 2024                                                                                                                                              |
| 4 |                                                                      |                                                                                                                                    | Central             | FA          | - 2 <sup>nd</sup> -3 <sup>rd</sup> Sep 2024                                                                                                                                              |
| 5 |                                                                      |                                                                                                                                    | Provincial          | DOE         | - 22 <sup>nd</sup> Nov 2023                                                                                                                                                              |
| 6 | GIS training (Basic/ Intermediate to Advanced)                       | To develop the capacity of national level government staffs for the GIS data standardization by using GIS software.                | Provincial          | FAC         | - 21 <sup>st</sup> Nov 2023                                                                                                                                                              |
| 7 |                                                                      |                                                                                                                                    | Central             | MoE (GDNPA) | <Basic><br>- 23 <sup>rd</sup> -26 <sup>th</sup> Apr 2024<br><Intermediate to Advanced><br>- 15 <sup>th</sup> -19 <sup>th</sup> Jul 2024<br>- 19 <sup>th</sup> -23 <sup>rd</sup> Aug 2024 |
| 8 |                                                                      |                                                                                                                                    | Central             | MoE (DGIS)  | - 5 <sup>th</sup> Apr 2023                                                                                                                                                               |
| 9 | Training for data entry and biomass calculation for forest inventory | To develop the capacity of central and government staffs to compile forest inventory data for biomass and carbon stock calculation | Central             | FA          | - 7 <sup>th</sup> Apr 2023                                                                                                                                                               |

## 4. GIS trainings

### Map utilization training

#### Contents

- How to interpret maps (topographic description, contour line, map scale, coordinate system, and map symbol)
- Field practices using compass and created maps
- Avenza app feature

#### Manuals

- Gdrive-Folder: 3. Basic Map Utilization Training



Training to PDoE (Dec, 2022)



Training to FAC (Dec, 2022)



## 4. GIS trainings

### Satellite image processing training

#### Contents

- Downloading satellite image from SEPAL (Website)
- Downloading satellite image from PLANET (Setting of plugin in GIS software, download procedure)
- Change detection using GIS software (Principal Component Analysis (PCA))

#### Manuals

- Gdrive-Folder: 4. Satellite Image Processing Training

Training to PDoE



Training to FAC



## 4. GIS trainings

### GIS training (Basic)

#### Contents

- Understanding GIS and Common Tools in GIS
- GIS Data Creating and GIS Data Downloading
- GIS Data Editing and Data Preparation for Mapping
- Clipping Vector Data and Masking Raster Data
- Topographic Analysis and Applying GIS Symbols
- Map Layout, Export to Geo-PDF and Import to Avenza Maps

#### Manuals

- Gdrive-Folder: 5. GIS Training (Basic)



## 4. GIS trainings

### GIS training (Intermediate to Advanced)

#### Contents

- Understanding of data standardization
- How to create and update geodatabase (setting of subtype and domain, data integration, data revision) by using GIS software and Microsoft Excel
- Creation of Data Product Specification (DPS)
- Creation of geodatabase for Protected Area management

#### Manuals

- Gdrive-Folder: 6. GIS Training (Intermediate to Advanced)



## 4. GIS trainings

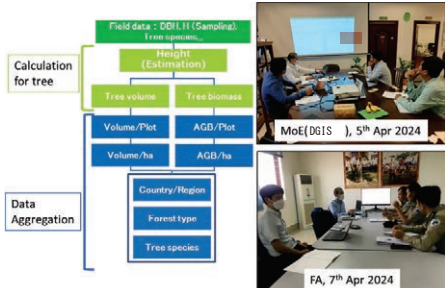
### Training for data entry and biomass calculation

#### Contents

- How to calculate biomass/volume based on the methodology of National Forest Inventory (NFI) manual
- Operation of forest biomass calculation program using Visual Basic for Applications (VBA)

#### Manuals

- JICA\_NFI\_Executive\_Summary
- JICA\_NFI\_Final\_Report\_Cambodia



## 4. GIS trainings

In the series of GIS trainings, the following capacity has been nurtured according to the needs and technical level of each organization.

|                   | National level                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                  | Sub-national level                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   | MoE (GDNPA&DGIS)                                                                                                                                                                                                                                             | FA                                                                                                                                                                                                                                               | DOE                                                                                                                                                                                                                                            | FAC                                                                                                                                                                                                                                            |
| Gained capacity   | <b>[Category]</b><br>GIS & RS<br>Forest inventory survey<br><br><b>[Capacity]</b> <ul style="list-style-type: none"> <li>GIS operation (Basic to Advanced)</li> <li>Satellite image analysis</li> <li>Compilation of forest inventory survey data</li> </ul> | <b>[Category]</b><br>GIS & RS<br>Forest inventory survey<br><br><b>[Capacity]</b> <ul style="list-style-type: none"> <li>GIS operation (Basic)</li> <li>Satellite image analysis</li> <li>Compilation of forest inventory survey data</li> </ul> | <b>[Category]</b><br>Map utilization<br>GIS & RS<br><br><b>[Capacity]</b> <ul style="list-style-type: none"> <li>Map interpretation</li> <li>GIS operation (Basic)</li> <li>Satellite image analysis</li> <li>Import maps to Avenza</li> </ul> | <b>[Category]</b><br>Map utilization<br>GIS & RS<br><br><b>[Capacity]</b> <ul style="list-style-type: none"> <li>Map interpretation</li> <li>GIS operation (Basic)</li> <li>Satellite image analysis</li> <li>Import maps to Avenza</li> </ul> |
| Contributed works | <ul style="list-style-type: none"> <li>PA management and related works by using GIS data</li> <li>Creation of LULC and detection of its change</li> <li>Summary of forest inventory data</li> </ul>                                                          | <ul style="list-style-type: none"> <li>Forest management by using GIS data</li> <li>Summary of forest inventory data</li> </ul>                                                                                                                  | <ul style="list-style-type: none"> <li>Forest management by using GIS data</li> <li>Detection and making summary of illegal logging</li> </ul>                                                                                                 | <ul style="list-style-type: none"> <li>Forest management by using GIS data</li> <li>Detection and making summary of illegal logging</li> </ul>                                                                                                 |

## 5. Expectation for the future

The capacity developed through the series of trainings contributes to the improvement of NFMS sustainable natural resource management.

### Monitoring

- Download satellite image (PLANET, SEPAL, etc.)
- LULC change detection
- Utilization of map for ground truthing

### Reporting & Verification

- Creation of map



### Measurement

- LULC change measurement (drone survey, satellite image analysis)
- Forest inventory

Thank you for your attention



## 2<sup>ND</sup> TECHNICAL WORKSHOP FOR PROJECT SNRM FROM JICA SUPPORT

### SUMMARY LESSON LEARNED FROM SNRM PROJECT THAT JICA SUPPORTS

28<sup>TH</sup> AUG 2024 IN CJCC-RUPP

MEAN NARO | Deputy Director of GDNPA | Ministry of Environment

## CONTENT

- 1-Protected Area in Cambodia
- 2-My experience in the Protected Area Management.
- 3-Learning from training courses supported by SNRM JICA
- 4-My Challenges
- 5-My Expectations and Suggestions.



## 1-PROTECTED AREA IN CAMBODIA

- Cambodia, located within the Indo-Burmese Peninsula, is recognized as a Global Biodiversity Hotspot and has the largest contiguous block of natural forest remaining on the Asian continent's mainland.



## 1-PROTECTED AREA IN CAMBODIA

- Cambodia was the first Southeast Asian country to establish a protected areas system when the area surrounding Angkor Wat temple was declared a national park in 1925.



## 1-PROTECTED AREA IN CAMBODIA

- In 2024 currently There are 73 Protected Areas in 9 categories covering over 7.4 million ha ( around 40% of Cambodia ) under the authority of the Ministry of Environment ( MOE ) through its General Directorate of Nature Protected Areas ( GDNPA ).
- Protected Areas in Cambodia play a critical role in the global environment, providing essential ecological services like climate regulation, biodiversity conservation, water resource protection, and local Community livelihood.

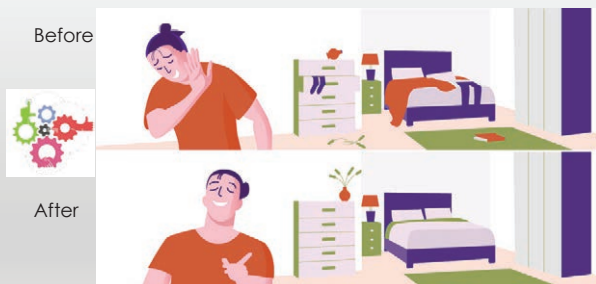


## 2- MY EXPERIENCE IN THE PROTECTED AREA MANAGEMENT.

- Main Task for My Duty**
  - Maintain and enhance the ecological and cultural values of protected areas
  - Promote participatory community engagement and support for conservation management
  - Develop innovative approaches to conservation and development, including opportunities for sustainable CBNRM Environment Friendly and financing mechanisms
  - Provide accurate, timely, and relevant information for the effective management of protected areas**
  - Strengthen protected area management effectiveness and work partnerships with government organizations, local authorities, conservation NGOs, development partners, and private companies.
- Problem Challenges:**
  - Habitat loss and degradation as a result of development activities inside PAs
  - Illegal logging, hunting, poisoning, fishing, or encroachment in PAs
  - Impacts of climate change
  - Zoning and management plans are not yet implemented in all PAs
  - Limited community engagement in PA planning and management
  - Ongoing land use conflict
  - Shortages of skilled staff
  - Limited infrastructure and financial resources
  - Baseline data and tools for collecting, storing, and sharing information on PA have not yet been improved.

## 3-LEARNING FROM TRAINING COURSES SUPPORTED BY SNRM JICA

Before



After



## 3-LEARNING FROM TRAINING COURSES SUPPORTED BY SNRM JICA

- Understanding about GIS
  - Identifies data sources
  - Download satellite imagery
  - Clean up data
  - Database Structure (One Standard) connect, Link, storage, and sharing.
- Tool and functional on GIS App
  - ArcGIS Pro, QGIS, and other software.
- Processing Analysis
  - Testing and Applying
- Checking and Assessment
- Discussion and Verification Output.

## 3-LEARNING FROM TRAINING COURSES SUPPORTED BY SNRM JICA



## ACTION SNRM TRAINING



### 3-LEARNING FROM TRAINING COURSES SUPPORTED BY SNRM JICA

- Apply new techniques or technology available for the concept
- Improve technique or prototype of primary data collection and Data Storage on Forest resource
- Improve capacity to process and analyze data from various software available
- Improve the functioning of data visualization at different levels and for all stakeholders.
- Increase chances of establishing a successful and productive cooperation with SNRM-JICA on GIS remote sensing for improved Protected Area Management.



### 5-MY EXPECTATION

- **The future of protected areas is constantly maintained:**
  - To develop a comprehensive understanding of PA
  - To implement a remote sensing-based monitoring system and Reporting system.
  - **To generate a prototype of database management with one standardized collection of storage and sharing.**
  - Capacity building for expertise in data processing, analysis, interpretation and visualization.
  - Strengthening Protected Areas Management: Increase patrolling frequency and effectiveness to reduce illegal logging, wildlife poaching, and encroachment within protected areas.
  - Public Awareness of protected area management
  - Improve Research and Development.
- **Next Plans and suggestions with SNRM-JICA Project**  
Could you consider my action plan for Forest Protection in Virajay National Park Cambodia?  
**Objective:**
  - Develop remote sensing techniques to improve forest monitoring in the Park.
  - Forest change detection forest Giant or Lost in Virajay National Park.
  - Verification tool for monitoring the result the accuracy must be over 75% for acceptable.
  - Provide basic training to PDofE with QGIS and Qfield verification tool survey.
  - Identifies hot spot areas of the forest that will be exposed to a disturbance.
  - Study suitable places for forest restoration.



**ព្រះរាជាណាចក្រកម្ពុជា  
ជាតិ សាសនា ព្រះមហាក្សត្រ**

**បទបញ្ជា ស្តីពីសមិទ្ធិផលនៃវត្តបណ្តុះបណ្តាល និងការប្រើប្រាស់ដីសាងសង់  
ដែលបានសិក្សាអំពីការគ្រប់គ្រងដីសាងសង់ការពារធម្មជាតិ**

បង្ហាញដោយ លោក វិ ជិត្យា អនុប្រធានការិយាល័យ

ស្ទឹងត្រែង ថ្ងៃទី២៧ ខែសីហា ឆ្នាំ២០២៤

### មាតិកា

១. សេចក្តីផ្តើម
២. ដំណើរការនៃវត្តបណ្តុះបណ្តាល
៣. លទ្ធផលនៃការងារនៃវត្តបណ្តុះបណ្តាល
៤. បញ្ហាប្រឈម
៥. សំណូមពរ

### ១. សេចក្តីផ្តើម

មន្ទីរបរិស្ថានខេត្តស្ទឹងត្រែង មានតំបន់ការពារធម្មជាតិចំនួន ០៩តំបន់ មានផ្ទៃដីសរុបប្រមាណជាង ៧០ម៉ឺនហិកតា ដើម្បីជួយដល់ការគ្រប់គ្រងតំបន់ការពារធម្មជាតិដែលមានវិសាលភាពធំធេង មន្ទីរបរិស្ថានខេត្ត ត្រូវការបច្ចេកទេសក្នុងការប្រើប្រាស់កម្មវិធីពាក់ព័ន្ធផ្សេងៗ ដែលជួយសម្រួលដល់ការគ្រប់គ្រង និងទប់ស្កាត់បទល្មើសមួយចំនួនក្នុងតំបន់ការពារធម្មជាតិ ។

មន្ទីរបរិស្ថានខេត្ត និងគម្រោងអភិវឌ្ឍន៍សមត្ថភាពក្នុងការគ្រប់គ្រងធនធានធម្មជាតិ ប្រកបដោយនិរន្តរភាពនៅថ្នាក់ជាតិ និងថ្នាក់ក្រោមជាតិ (JICA SNRM) បានរៀបចំវគ្គបណ្តុះបណ្តាលបច្ចេកទេសជូនមន្ត្រីនៃមន្ទីរបរិស្ថាន ដើម្បីកសាងសមត្ថភាពបន្ថែម ក្នុងការគ្រប់គ្រងតំបន់ការពារធម្មជាតិ ។

## ២. ដំណើរការនៃវគ្គបណ្តុះបណ្តាល

ក្រុមការងារ នៃមន្ទីរពិស្តារខេត្តស្ទឹងត្រែង (ជាគ្រូបង្គោល) បានចូលរួមវគ្គបណ្តុះបណ្តាល សរុបចំនួន ៧លើក រួមមាន៖

- វគ្គបណ្តុះបណ្តាលការប្រើប្រាស់ផ្លូវចំនួន ០១លើក
- វគ្គបណ្តុះបណ្តាលការប្រើប្រាស់ផែនទីចំនួន ០២លើក
- វគ្គបណ្តុះបណ្តាលការប្រើប្រាស់រូបភាពផ្កាយរណបចំនួន ០១លើក
- លើកវគ្គបណ្តុះបណ្តាលការប្រើប្រាស់ផែនទី និងការប្រើប្រាស់ផ្លូវចំនួន ០២លើក
- លើកវគ្គបណ្តុះបណ្តាលការប្រើប្រាស់រូបភាពផ្កាយរណប និងការប្រើប្រាស់ផ្លូវចំនួន ០១លើក

## ២. ដំណើរការនៃវគ្គបណ្តុះបណ្តាល (ត)



## ២. ដំណើរការនៃវគ្គបណ្តុះបណ្តាល (បប)

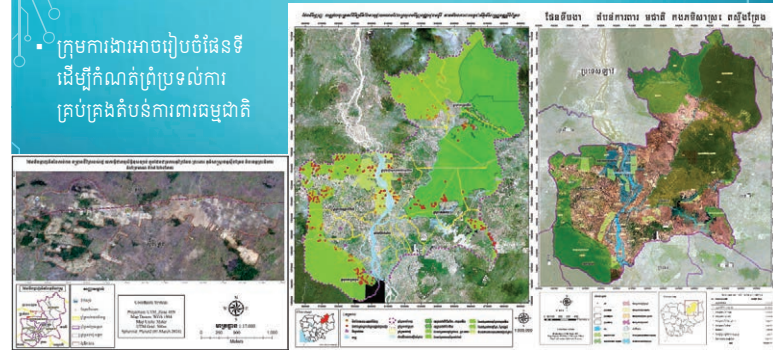
នៅចុងបញ្ចប់នៃការបណ្តុះបណ្តាល គម្រោងបានផ្តល់សម្ភារៈប្រើប្រាស់មួយចំនួន ដូចជា៖

- កំពូទំរង់លើក ចំនួន ០២ឈុត
- ទូរស័ព្ទស្ថាពរហ្វូនប្រើប្រាស់ទីវាល ចំនួន ០២គ្រឿង
- ផ្លូវ DJI Phantom4 V2.0 ចំនួន ០១ឈុត
- ម៉ាស៊ីនក្តើងប្រើប្រាស់នៅទីវាល ចំនួន ០១គ្រឿង



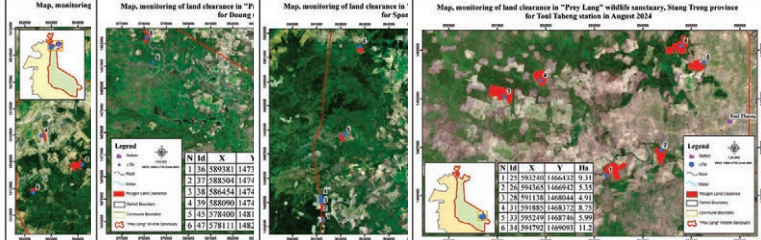
## ៣. លទ្ធផលគ្រោយទទួលបានវគ្គបណ្តុះបណ្តាល

- ក្រុមការងារអាចរៀបចំផែនទី ដើម្បីកំណត់ព្រំប្រទល់ការ គ្រប់គ្រងតំបន់ការពារធម្មជាតិ



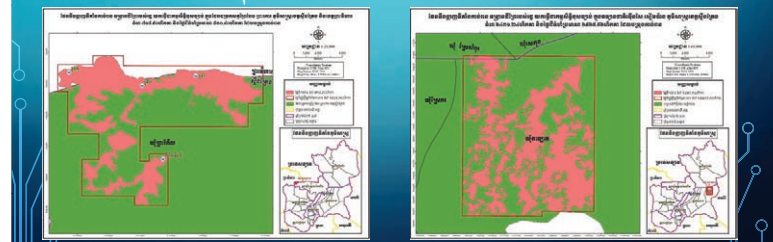
## ៣. លទ្ធផលគ្រោយទទួលបានវគ្គបណ្តុះបណ្តាល (ត)

- ក្រុមការងារអាចទាញយករូបភាពផ្កាយរណប សម្រាប់ប្រើប្រាស់ប្រចាំថ្ងៃ ក្នុងការបង្កើនប្រសិទ្ធភាពទប់ស្កាត់ បទល្មើសកាប់ទុនដីព្រៃទាន់ពេលវេលា



## ៣. លទ្ធផលគ្រោយទទួលបានវគ្គបណ្តុះបណ្តាល (ត)

- ក្នុងខែមេសា ឆ្នាំ២០២៤ ក្រុមការងារ បានទាញយករូបភាពផ្កាយរណប សម្រាប់ផលិតផែនទីបង្ហាញពី តាំងកាប់ទុន និងទំហំផ្ទៃដីនៃការកាប់ទុន នៅចំណុចអូរល្វើប្រាំដំឡើង ក្នុងដែនជម្រកសត្វព្រៃនេប- រោរ និងតំបន់ត្រឡាពស់ ក្នុងឧទ្យានជាតិវិទ្យុស្ថានស្ទឹងត្រែង។



### ៣. លទ្ធផលក្រោយទទួលបានវគ្គបណ្តុះបណ្តាល (បង់)



### ៥. សំណូមពរ

- ស្នើសុំឱ្យមានវគ្គបណ្តុះបណ្តាលពាក់ព័ន្ធបច្ចេកទេសថ្មីៗ ដើម្បីពង្រឹងសមត្ថភាពបន្ថែម។

### ៤. បញ្ហាប្រឈម

- រូបភាពផ្កាយរណប មានទំហំផ្ទុកធំ ធ្វើឱ្យការទាញយករូបភាពមកប្រើប្រាស់ត្រូវការពេល។
- ការផ្តួចផ្តើមរូបភាពដែលបានពីឧបករណ៍ជ្រូន សម្រាប់ផលិតជាផែនទី នៅមានកម្រិត។
- ការប្រើប្រាស់មុខងារមួយចំនួន ក្នុងកម្មវិធីArcGIS និងArcGIS Pro នៅមានកម្រិត។




**“សមិទ្ធផលដែលក្រុមការងាររដ្ឋបាល  
ព្រៃឈើទទួលបានពីគម្រោងការអភិវឌ្ឍ  
និងសមត្ថភាពសម្រាប់ការត្រួតពិនិត្យ  
ធនធានធម្មជាតិប្រកបដោយនិរន្តរភាព”**

នៅថ្ងៃទី២៨ ខែសីហា ឆ្នាំ២០២៤  
អគារ JACC នៃសាកលវិទ្យាល័យភូមិន្ទពេញ



### មាតិកា

- ១.ការចូលរួមអនុវត្តគម្រោង
- ២.អត្ថប្រយោជន៍ទទួលបានពីគម្រោង
- ៣.បញ្ហាប្រឈម
- ៤.សំណូមពរ



### ១.ការចូលរួមអនុវត្តគម្រោង

គម្រោង SNRM បានចាប់ផ្តើមចុះហត្ថលេខាជាមួយក្រសួងកសិកម្មរុក្ខាប្រមាញ់ និងនេសាទ (១៨ មីនា ២០២០) មានរយៈពេល ៤ឆ្នាំ (ឆ្នាំ២០២០ ដល់ ឆ្នាំ២០២៤)។

**១.១ ឧបករណ៍ និងសម្ភារៈ**

កាលពីថ្ងៃទី០៤ខែឧសភា ឆ្នាំ២០២២ និងថ្ងៃទី ២០ ខែកញ្ញា ២០២៣ គម្រោងបានផ្តល់សម្ភារៈដល់ក្រុមការងាររដ្ឋបាលព្រៃឈើ ដើម្បីបំពេញការងារក្នុងវិស័យព្រៃឈើ ក្នុងដំណើរការតាមដាននៃ បម្រែបម្រួលនៃការប្រើប្រាស់ដីនៅទីកន្លែង។

- ក. ជ្រុង ០១គ្រឿង (Sensefly eBee Geo)
- ខ. កុំព្យូទ័រយូរដៃ ០១គ្រឿង
- គ. GNSS Receiver ០១គ្រឿង
- ឃ. កុំព្យូទ័រលើតុ ០១គ្រឿង

តង់ តុ កៅស៊ូ វិទ្យុទាក់ទង និងសម្ភារៈមួយចំនួនបន្ថែមទៀត។

កម្មវិធី៖ កម្មវិធីArcGIS10.7, កម្មវិធី eMotion និងកម្មវិធីPix4D។





## ២.អត្ថប្រយោជន៍ទទួលបានពីគម្រោង

ក្នុងកំឡុងពេលនៃការអនុវត្តគម្រោង SNRM មន្ត្រីរដ្ឋបាលព្រៃឈើថ្នាក់កណ្តាលចំនួន ៩រូប បានបង្កើននូវចំណេះដឹងតាមរយៈការកសាងសមត្ថភាព លើវគ្គបណ្តុះបណ្តាល “ បច្ចេកទេសនៃការប្រើប្រាស់ឧបករណ៍ជ្រួត និងដំណើរដំណើរការផលិតផែនទី ” ដែលមានចំនួន១៥ថ្ងៃ (៣វគ្គ)

- ខេត្តស្ទឹងត្រែង សហគមន៍ព្រៃឈើអ្នកតាគង់
- ខេត្តសៀមរាប សហគមន៍ព្រៃឈើទឹកដប់ខ្នារពោធិ៍
- ខេត្តកំពង់ធំ សហគមន៍ព្រៃឈើព្រៃហ៊ុម



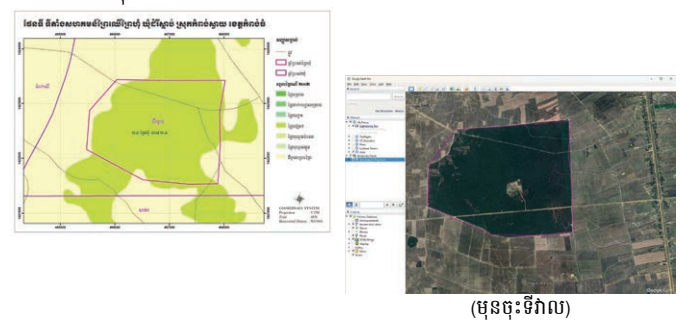
## ២.អត្ថប្រយោជន៍ទទួលបានពីគម្រោង

- ២.១ សកម្មភាព និងលទ្ធភាពនៃវគ្គបណ្តុះបណ្តាលកន្លងមក
- ក.ការងារទីវាល
  - ការដំណើរព្រំប្រទល់ដីដែលគ្រោងថតរូប
  - ការស្វែងរកទីតាំងហោះហើរ និងហោះហើរ (កត្តាអនាម័យផលជូនជាទីទំនាប់ គ្មានថ្លៃថ្នូរ ឬបង្គោលភ្លើងអគ្គិសនី)
  - ការភ្ជាប់ទីតាំងគោល (Setting of base camp)
  - ការស្វែងយល់ពីលក្ខណៈបច្ចេកទេសមុនហោះហើរ (សីតុណ្ហភាព ទិសខ្យល់ និងកំលាំងខ្យល់)
  - ការបង្កើតគន្លងហោះ (Flight planning)
  - ដំណើរការនៃការហោះហើរ (Take-off and landing)
  - ការតាមដានការហោះហើរនិង ការថតរូប



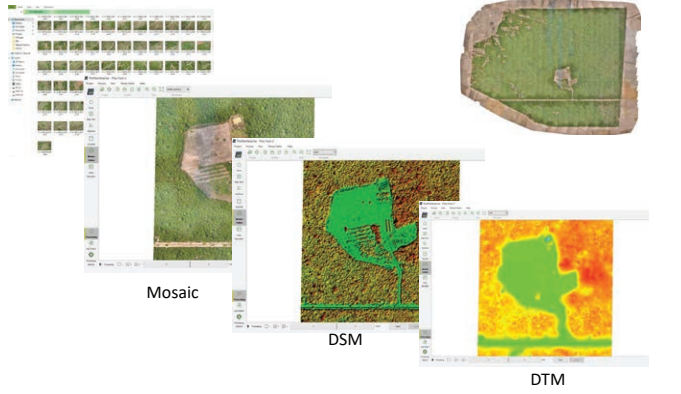
## ២.អត្ថប្រយោជន៍ទទួលបានពីគម្រោង

- ២.១ សកម្មភាព និងលទ្ធភាពនៃវគ្គបណ្តុះបណ្តាលកន្លងមក
- ខ.ការងារបច្ចេកទេស
- ការដំណើរព្រំប្រទល់ដីដែលគ្រោងថតរូប
  - ការបង្កើនភាព និងផលិតផែនទី



## ២.អត្ថប្រយោជន៍ទទួលបានពីគម្រោង

- ២.១ សកម្មភាព និងលទ្ធភាពនៃវគ្គបណ្តុះបណ្តាលកន្លងមក
- ខ.ការងារបច្ចេកទេស (ក្រោយចុះទីវាល)



## ៣.បញ្ហាប្រឈម

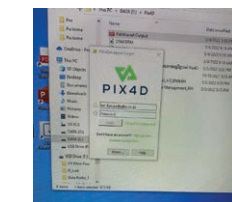
- ៣.១ ធនធានមនុស្ស
- ការចូលរួមពីក្រុមការងារ ៥ទៅ ៦នាក់
  - មន្ត្រីដែលមានសមត្ថភាពអាចប្រើប្រាស់នូវកម្លាំងច្រើន
  - ការសម្រេចចិត្តខ្ពស់ និងការទទួលខុសត្រូវខ្ពស់
- ៣.២ សម្ភារៈ
- កំលាំងដែលមានទំហំធំ ក្នុងការបង្កើនភាព
  - កំលាំងប្តូរដៃ ៣ - ៤គ្រឿង សម្រាប់ការហោះហើរ

★ ទ្រុឌត្រូវមិនអាចហោះហើរ នៅពេលមានភ្លៀង ខ្យល់ខ្លាំង និងកំដៅខ្ពស់



## ៤.សំណូមពរ

- សូមបន្តការផ្តល់ឱកាសដល់មន្ត្រីរដ្ឋបាលព្រៃឈើ ក្នុងការបង្កើននូវចំណេះដឹងលើបច្ចេកទេសថ្មីៗ
- គួរបន្ថែមពេលវេលានៃវគ្គបណ្តុះបណ្តាល។





បទបង្ហាញ ស្តីពី  
គម្រោង JICA SNRM ធានាបរិស្ថាន  
វគ្គបណ្តុះបណ្តាល ពង្រីកសមត្ថភាពដល់មន្ត្រី  
រដ្ឋបាលព្រៃឈើមូលដ្ឋាន



វគ្គបណ្តុះបណ្តាលមាន៖

- របៀបមើលសន្លឹកផែនទី
- របៀបប្រើកម្មវិធី ArcGISPro
- របៀបផលិតផែនទីប្រើប្រាស់កាតព្វកិច្ចរូបភាព
- របៀបប្រើប្រាស់ ជ្រុង ដើម្បីបង្កើតរូបភាព
- របៀបបង្កើតរូបភាពពី ជ្រុង ដើម្បីផលិតផែនទី

ដោយប្រើកម្មវិធី Pix4Dmapper

របៀបមើលសន្លឹកផែនទី



របៀបប្រើកម្មវិធី ArcGISPro

- ព័ត៌មានអំពី ArcGIS Pro/Open ArcGIS Pro:



របៀបផលិតផែនទីប្រើប្រាស់កាតព្វកិច្ចរូបភាព

