**Supplementary Material**

**Impact of forest succession and land management on soil organic carbon stocks in Singapore**

Michael Kleine1,\*, Subhadip Ghosh2,3, Ernst Leitgeb4, Ambros Berger5, Hassan bin Ibrahim6,Thomas Gschwantner5, Lai Fern Ow2 , Kerstin Michel4

1Austrian Natural Resources Management and International Cooperation Agency, Karlsgasse 9/2, 1040 Vienna, Austria

2 Centre for Urban Greenery and Ecology, National Parks Board, Singapore 259569

3 School of Environmental and Rural Science, University of New England, Armidale 2351, Australia

4 Department of Forest Ecology and Soil, Austrian Research Centre for Forests, Seckendorff-Gudent-Weg 8, 1131 Vienna, Austria

5 Department of Forest Inventory, Austrian Research Centre for Forests, Seckendorff-Gudent-Weg 8, 1131 Vienna, Austria

6 International Biodiversity Conservation, National Parks Board, Singapore 259569

**Table S1**: Example: Plot #13 – Evidence for secondary forests representing natural forests succession.

|  |  |  |
| --- | --- | --- |
| Criterion /Question | Evidence | Result |
| Stand does not have a closed emergent canopy of late succession native species (at the most a few scattered large trees)? | * There are no emergent canopy trees (>60cm) per hectare, * The total AGB of 198 [Mg ha-1] and lower is typical for naturally regenerating secondary forests after disturbance in Southeast Asia. | **Class 2**  **Secondary Forests representing natural forests succession** |
| Is there a larger pool of medium sized trees of native species? | * The stand is dominated by medium-sized late succession native species (61%) dominated by *Garcinia* spp., *Callophyllum* spp., *Litsea* spp., *Syzygium* spp. and *Palaquium* spp. * More than one-third (39%) of trees belong to early succession species including *Rhodamnia* spp. and *Macaranga* spp. |
| There is no evidence of past land conversion or plantation activities? | * There is total absence of any tree species used for forest and/or agriculture plantation |

Due to the wide range of stand conditions found in Class 3 originating either from tree plantations or fruit orchards, two examples are presented.

**Table S2:** Example: Plot #24 – Evidence for secondary forests **after tree plantation**/fruit orchard

|  |  |  |
| --- | --- | --- |
| Criterion /Question | Evidence | Result |
| There is no closed emergent canopy or scattered large trees of late succession native species? | * There are no emergent canopy trees (>60cm) per hectare. | **Class 3**  **Secondary forests after tree plantation/fruit orchard** |
| Is there a larger pool of medium sized trees of either exotic species or mixed with native fruit trees/early-succession species? | * The stand is dominated by medium-sized exotic species (87%) made up of *Acacia auriculiformis*, * The rest are early-succession native species of small diameters – mainly *Vitex pinnata*, * The low total AGB of 105 [Mg ha-1] is typical for tree plantations |
| Is there evidence of past tree plantation activities? | * Dominance of *Acacia auriculiformis* points to former intensive tree plantation management |

**Table S3:** Example: Plot #7 – Evidence for secondary forests after tree plantation/**fruit orchard**

|  |  |  |
| --- | --- | --- |
| Criterion /Question | Evidence | Result |
| There is no closed emergent canopy or scattered large trees of late succession native species? | * There are no emergent canopy trees (>60cm) per hectare. | **Class 3**  **Secondary forests after tree plantation/fruit orchard** |
| Is there a larger pool of medium sized trees of either exotic species or mixed with native fruit trees/early-succession species? | * The stand is dominated by medium-sized planted fruit trees *(Dimocarpus longan*, *Durio zebethinus*, *Artocarpus integer*) * The rest are native species of small diameters – mainly (*Dracaena fragrans*, *Ficus* spp.), * The total AGB of 256 [Mg ha-1] is at the higher end because of earlier dense planting of fruit trees. |
| Is there evidence of past tree plantation activities? | * Dominance of *Acacia auriculiformis* points to former intensive tree plantation management |

**Table S4:** Example: Plot #2 – Evidence for Secondary Forests after agriculture crop cultivation

|  |  |  |
| --- | --- | --- |
| Criterion /Question | Evidence | Result |
| There is no closed emergent canopy or scattered large trees of late succession native species? | * There are no emergent canopy trees (>60cm) per hectare, | **Class 4**  **Secondary Forests after agriculture crop cultivation** |
| Is the stand dominated by invasive tree species? | * The stand is dominated by the invasive *Spathodea campanulat*a (African Tulip) colonizing open areas with aggressive seed dispersal by wind. * The total AGB of 87 [Mg ha-1] is low, but made up mostly of African Tulip (88%). |
| Is there evidence of past intensive agriculture with soil tillage? | * Plot located in an area known from records to be used for intensive agriculture crop cultivation. |