

## Supplementary Information

**Table S1.** Summary of carbon stocks data in the Sembilang National Park used to estimate carbon emissions. Data are reported in the literature [29].

| Carbon pool     | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 | Mean | SD  |
|-----------------|--------|--------|--------|--------|--------|--------|------|-----|
| Soil            | 778.3  | 1223.9 | 1074.2 | 936.7  | 914.8  | 948.8  | 979  | 152 |
| Tree            | 383.5  | 279.9  | 255.8  | 418    | 219.6  | 245.9  | 300  | 81  |
| Root            | 33.8   | 2.4    | 10.9   | 27.7   | 30.2   | 9.4    | 19   | 13  |
| Woody debris    | 29.9   | 16.9   | 10.3   | 24.2   | 21.6   | 18.1   | 20   | 7   |
| Total biomass   | 417.3  | 282.3  | 266.7  | 445.7  | 249.8  | 255.3  | 320  | 88  |
| Total ecosystem | 1198   | 1542.4 | 1376.7 | 1394.3 | 1168.9 | 1234.5 | 1319 | 144 |

**Table S2.** Summary of emissions factor for mangrove conversion to coconut plantation, fishpond, and open area (forest clearing or deforestation).

| Land use change                     | Percentage of biomass carbon stocks loss | Percentage of soil carbon stocks loss | Reference |
|-------------------------------------|--|---------------------------------------|-----------|
| Mangrove forest: coconut plantation | 88%                                      | 95%                                   | [300,31]  |
| Mangrove forest: fishpond           | 83%                                      | 52%                                   | [32]      |
| Mangrove forest: open area          | 100%                                     | no change                             | [32]      |

**Table S3.** Summary of carbon emissions calculation for each land use change and period. PMF—primary mangrove forest; SMF—secondary mangrove forest; CP—coconut plantation; OA—open area; FP—fishpond.

| LUC    | 1985–2000                                |                |   |                                       |             |  |               | 2000–2020  |  |                |   |                                       |             |  |               |  |
|--------|--|----------------|---|---------------------------------------|-------------|--|---------------|--|--|----------------|---|---------------------------------------|-------------|--|---------------|--|
|        | Biomass C stocks (MgC ha <sup>-1</sup> ) | EF biomass (%) | Biomass C stocks loss (MgC ha <sup>-1</sup> ) | Soil C stocks (MgC ha <sup>-1</sup> ) | EF soil (%) | Soil C stocks loss (MgC ha <sup>-1</sup> ) | LUC area (ha) | Biomass and soil CO <sub>2</sub> emissions (Mg CO <sub>2</sub> eq) | Biomass C stocks (MgC ha <sup>-1</sup> ) | EF biomass (%) | Biomass C stocks loss (MgC ha <sup>-1</sup> ) | Soil C stocks (MgC ha <sup>-1</sup> ) | EF soil (%) | Soil C stocks loss (MgC ha <sup>-1</sup> ) | LUC area (ha) | Biomass and soil CO <sub>2</sub> emissions (Mg CO <sub>2</sub> eq) |
| PMF-CP | 320                                      | 0.88           | 281.6   | 979                                   | 0.95        | 930.05                                     | 667.13        | 2,963,870  | 320                                      | 0.88           | 281.6   | 979                                   | 0.95        | 930.05                                     | 290.63        | 1,291,187  |
| PMF-OA | 320                                      | 1              | 320   | 979                                   | 0           | 0  | 178.29        | 209,194  | 320                                      | 1              | 320   | 979                                   | 0           | 0  | 1844.22       | 2,163,885  |
| PMF-FP | 320                                      | 0.83           | 265.6   | 979                                   | 0.52        | 509.08                                     | 66.49         | 188,864  | 320                                      | 0.83           | 265.6   | 979                                   | 0.52        | 509.08                                     | 110.97        | 315,210  |
| SMF-CP | 243.2                                    | 0.88           | 214.016                                       | 979                                   | 0.95        | 930.05                                     | 1970.81       | 8,267,368  | 243.2                                    | 0.88           | 214.016                                       | 979                                   | 0.95        | 930.05                                     | 386.18        | 1,619,990  |
| SMF-OA | 243.2                                    | 1              | 243.2   | 979                                   | 0           | 0  | 260.45        | 232,252  | 243.2                                    | 1              | 243.2   | 979                                   | 0           | 0  | 1409.75       | 1,257,121  |
| SMF-FP | 243.2                                    | 0.83           | 201.856                                       | 979                                   | 0.52        | 509.08                                     | 27.2          | 70,904   | 243.2                                    | 0.83           | 201.856                                       | 979                                   | 0.52        | 509.08                                     | 40.54         | 105,678  |

## References

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