Sustainable Wetlands Adaptation and Mitigation Program (SWAMP)

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Summary

Carbon-rich tropical wetlands (mangroves and peatlands) are important in climate change adaptation and mitigation strategies and provide numerous ecosystem services such as storm protection, nursery areas for fish, habitat for rare species, long-term storage of carbon, and food, fiber, and fuel for humans. Because of their importance we developed the Sustainable Wetlands Adaptation and Mitigation Program (SWAMP) to assist countries with their accounting and conservation of tropical wetlands. SWAMP is a collaborative effort between the Center for International Forestry Research, USDA Forest Service, Oregon State University and many partners through support from the US Agency for International Development.

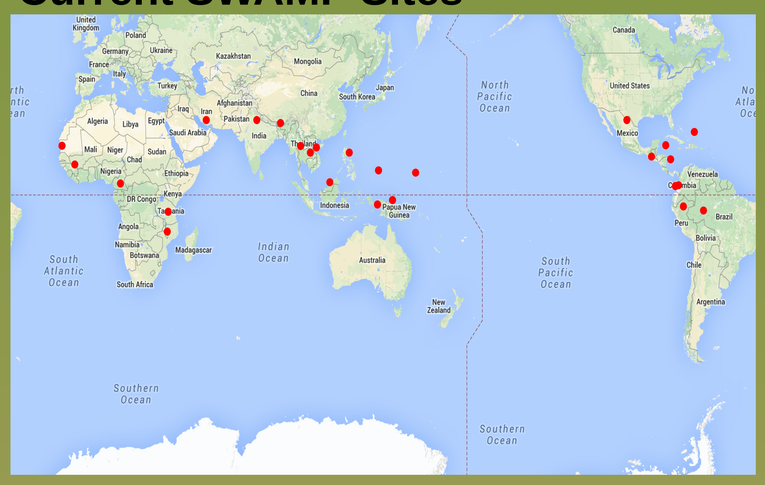
SWAMP Objectives

- Advancing the science and knowledge of Measurement, Reporting, and Verification (MRV) of carbon storage and greenhouse gas emissions specific to tropical wetlands
- Creating networks of permanent forested wetland plots and professional staff designed to fill critical knowledge gaps in wetland carbon dynamics
- Building capacity and outreach of regional academic and research counterparts for scientific inquiry and climate change research

SWAMP Goals

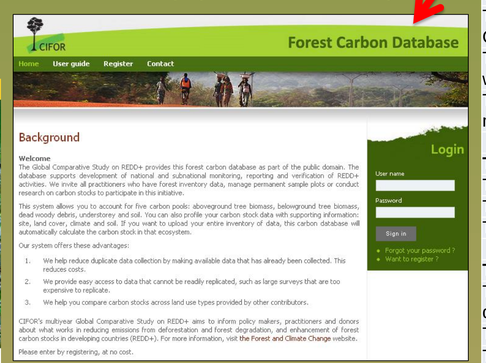
- Quantify greenhouse gas emissions and C stocks from both intact wetlands and sites that have undergone land cover or management changes
- Develop ecosystem modeling tools and remote sensing technology to scale up C measurements
- Quantify the role of tropical wetland systems in climate change adaptation and mitigation
- Develop capacity building and outreach activities with associated countries that will lead to sustainability of local communities, livelihoods and infrastructure
- Provide policy relevant information for Reduced Emissions from Deforestation and Degradation participation (REDD+) and IPCC reporting (Intergovernmental Panel on Climate Change)

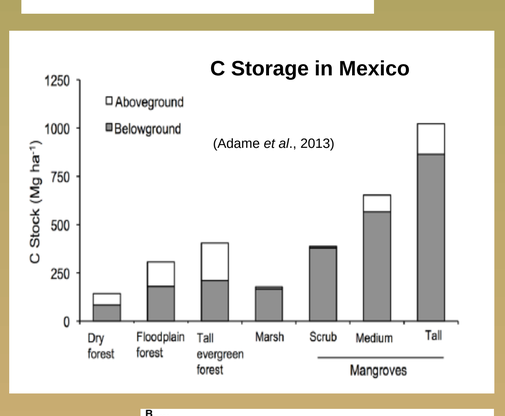
Current SWAMP Sites

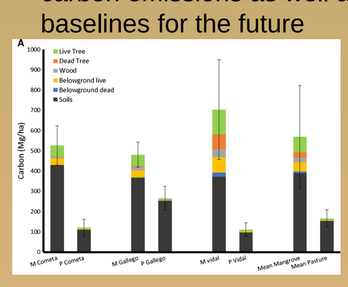


Quantify Greenhouse Gas (GHG) Emissions and Stocks

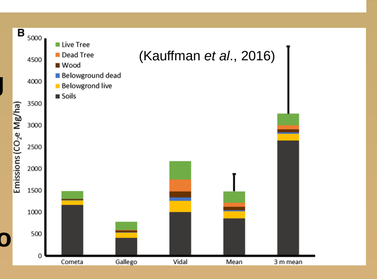
- Quantify (GHG) fluxes associated with land use change at the plot scale for intact, degraded and converted wetlands
- GHG's include CO_2, CH_4 and Nitrous Oxide (N_2O)
- Such studies will be conducted in new landscapes where such data are scarce
- Develop efficient and accurate approaches for the quantification of carbon stocks of tropical wetlands
- Establish a series of permanent wetland plots where C stocks are measured over time to determine C sequestration rates
- Quantify C stock changes from other common land uses in tropical wetlands to establish past carbon emissions as well as baselines for the future







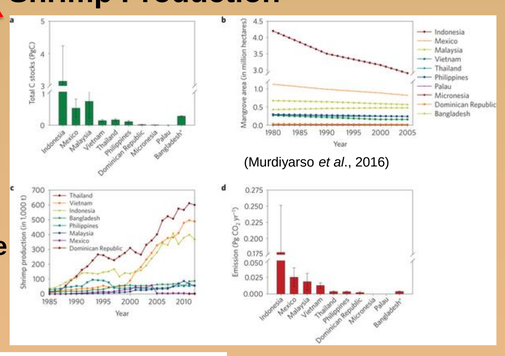
Changes in C pools & resulting emission of C and following mangrove conversion to pasture in Mexico



Why Tropical Mangroves and Peatlands?

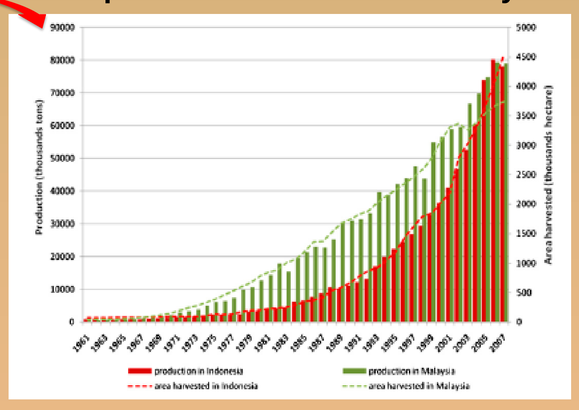
1. **Under intense development**
2. **Flood control**
3. **Rising sea levels**
4. **Storm protection**
5. **Habitat for flora and fauna**
6. **Source of wood products**
7. **Source of nutrients and energy**
8. **Ecotourism**
9. **Little known about ecosystems**
10. **Carbon-rich - 0.25% of land surface but 3% of world terrestrial C**
11. **Feedbacks to climate change**

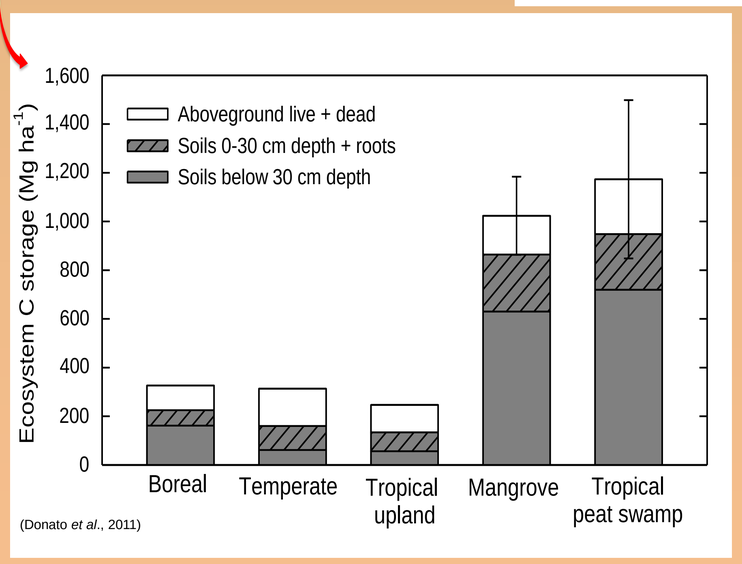
Change in Mangrove Area and Shrimp Production



(Murdiyarso *et al*., 2016)

Trend in Peatland Oil Palm Development - Indonesia and Malaysia





(Donato *et al*., 2011)

SWAMP Products To Date

1. **65 Publications**
2. **100+ Presentations**
3. **41 Trainings and Workshops**
4. **25+ Countries Sampled**
5. **18 Graduate Students and Post Docs Trained**
6. **100's of Partners**

http://www1.cifor.org/swamp/home.html

UID: 101713

Global Wetland Mapping

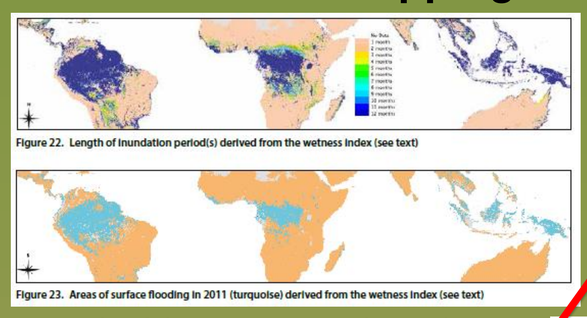


Figure 22. Length of inundation period(s) derived from the wetness index (see text)

Figure 23. Areas of surface flooding in 2011 (turquoise) derived from the wetness index (see text)

Example of data, remote sensing and mapping activities being used to develop the global wetlands map (Gumbricht 2012).

Develop Modeling Tools and Remote Sensing Technology to Scale Up C Measurements

- While dynamic carbon, climate, and land use change models exist for boreal and temperate wetlands, they are lacking for tropical wetlands
- We will adapt, parameterize and validate existing models for tropical wetlands.
- Based on intensive field studies, quantitative modeling and remote sensing, we will scale up C stocks to regional/global levels
- Modeling and scaling information will be used to analyze policy alternatives and target threated C stocks for conservation

Recent Products/Planning

1. SWAMP Toolbox – Powerpoint presentations and text on tropical wetlands
2. Special Journal Publication in *Wetlands Ecology and Management* in 2016
3. Global Wetlands Map
4. Establishment of long-term research sites
5. Establishment of SWAMP data bases that would be linked to other online databases

SWAMP Toolbox

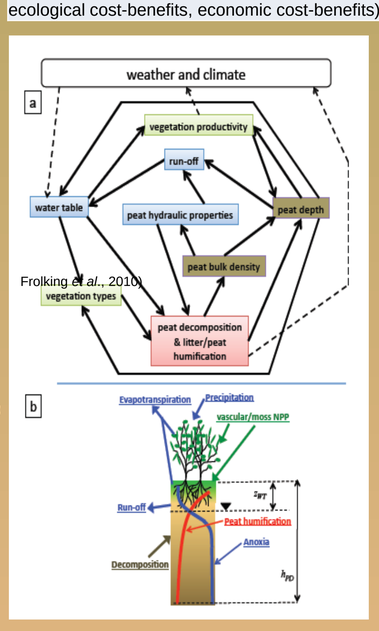
Theme A: Wetlands and Climate Change
Topic A1 – Introduction (definitions, distributions, trends)
Topic A2 – Wetlands in the UNFCCC processes (RED, REDD, REDD+, NAMAs)
Topic A3 – Wetlands in the IPCC processes (National GHG Inventory, National Communication, Methodologies, and Guidelines)
Topic A4 – Wetlands and ecosystem services (Unique coastal zone, freshwater wetlands, MEA, biodiversity values)
Topic A5 – Wetlands in the tropics (extent, types, potentials for CC adaptation and mitigation)

Theme B: Wetlands for Adaptation to Climate Change
Topic B1 – Ecosystem-based adaptation
Topic B2 – Mangroves forests for adaptation: potentials and vulnerability
Topic B3 – Peat swamp forests for adaptation: potentials and vulnerability

Theme C: Mitigation of Climate Change through Wetlands
Topic C1 – Reducing emissions and enhancing removals (land-use change, fire, drainage, emissions)
Topic C2 – Peatlands C-stocks assessment (carbon pools, allometric equations)
Topic C3 – Mangrove C-stocks assessment (carbon pools, allometric equations)
Topic C4 – Flux measurements (chamber method, flux tower, spatial and temporal variability)
Topic C5 – Remotely sensed assessment (choice of sensors and resolutions, airborne or gound-base sensors, ground-truthing, modeling tools)

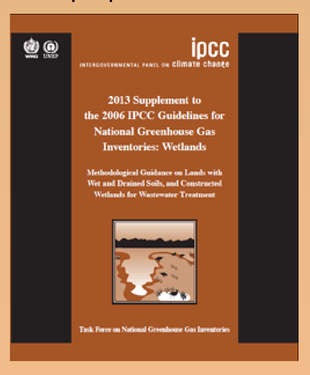
Theme D: Project Development in Wetlands
Topic D1 – Developing reference level (step-wise approach, statistical data, socio-economic factors, modeling approach)
Topic D2 – Monitoring, reporting and verification (transparancy, accuracy, compatibility)
Topic D3 – Database development (Emission factors, Activity data)

Theme E: Beyond Carbon
Topic E1 – Mangrove ecosystem dynamics (sedimentation and burial rates, sea level rise, ecosystem services)
Topic E2 – Biodiversity in wetlands ecosystems (biodiversity platform and ecosystem services, assessing biodiversity, valuing biodiversity)
Topic E3 – Coastal zone restoration for sustainable livelihoods
Topic E4 – Fish and non-timber products (man-made and natural production system, ecological cost-benefits, economic cost-benefits)



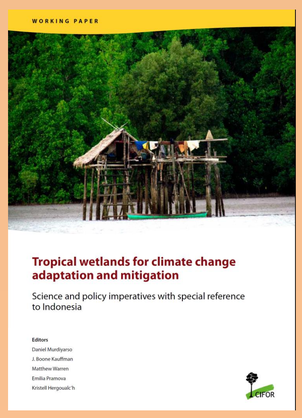
Provide Relevant Information for REDD+ and IPCC Reporting

- SWAMP activities lead to better carbon accounting and the potential development of carbon credit markets to offset industrial development
- SWAMP will help countries refine their emission reporting from wetlands undergoing change for IPCC and REDD+ reporting purposes.



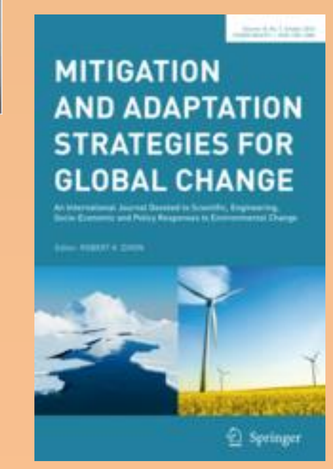
SWAMP Capacity Building

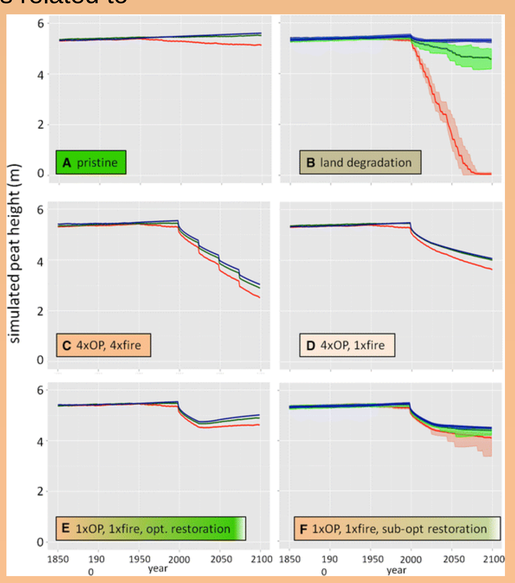
- Graduate student opportunities for young scholars attending both host country institutions and US institutions
- Development of collaborations among International, CIFOR and US scientists
- Undergraduate students, graduate students and land managers will obtain experience from field research and workshops
- Development of infrastructure for future C studies and related policy development
- Development of laboratory infrastructure for techniques related to the analysis of samples and interpretation of the data



Quantify the Role of Tropical Wetland Systems in Climate Change Adaptation and Mitigation

- Develop an understanding of the role of ecosystem services in reducing social vulnerability related to wetland degradation
- Analyze how sea level rise and other ramifications of climate change affect wetland ecosystem services
- Propose institutional or technical measures for reducing the vulnerability social-ecological systems related to tropical wetlands





Simulated peat height for final 250 years of simulation (1850–2100 CE) for land-use scenarios. **a** S1, pristine forest; **b** S2, land degradation; **c** S3, four-rotation oil palm with fires; **d** S4, four-rotation oil palm with one fire; **e** S5, one-rotation oil palm with fire and optimal restoration; and **f** S6, four-rotation oil palm with fire and sub-optimal restoration, for three climate models—GFDL (*red*), HadESM (*green*), and MIROC (*blue*) (Warren et al. 2016).