Development of Greenhouse-gas Sink/Source Control Technologies through Conservation and Efficient Management of Terrestrial Ecosystems

Source control

Land resources management and the empowerment for local community

Mitigation of CH_4, N_2O emission

Afforestation in tropical forest

Construction of integrated platform and common information system for promoting the research project

Sink/Source control in tropical peat swamp

Ecosystem management in shifting-cultivation region

Budget ; \1,3B (2003～2007)

Project Leader
K. YAMADA

Sink enhancement

Afforestation in arid land

Reporter: K. Iiyama (Univ. of Tokyo)

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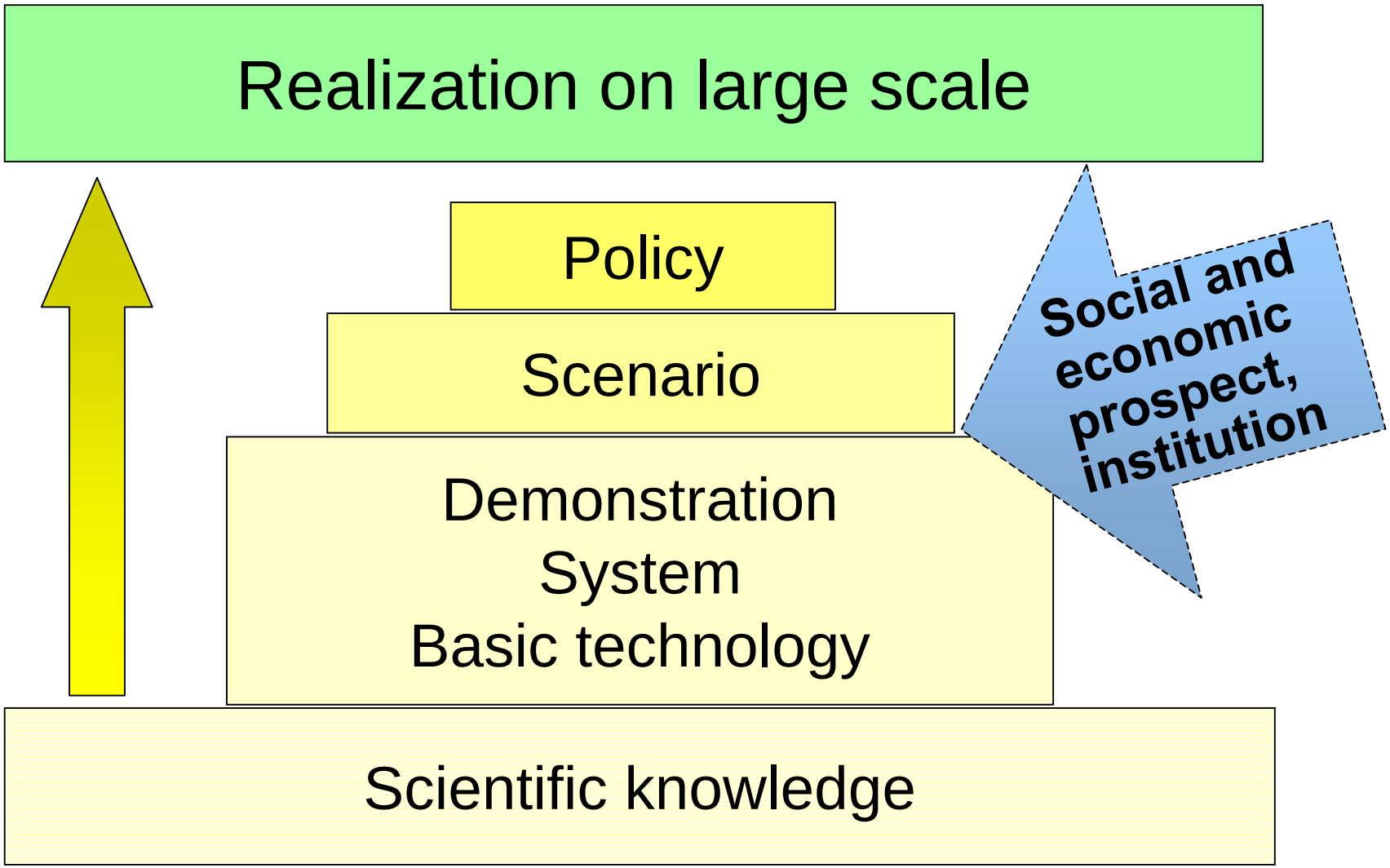
Objectives

Establishment of GHG sink/source control Technologies in Terrestrial ecosystems.

These technologies should connect with concrete options for policy maker after 2nd period of Kyoto Protocol (2013～).



Framework of SSCP

Basic technologies of SSCP

1. Improvement of vegetation environment
   ・Water ・Soil (pH, salt, moisture, atmosphere)
2. Plant improvement
   ・High growth rate (elite clone, hybrid, high productivity)
   ・High adaptability to severe environment
   ・DNA marker
3. Sustainable ecosystem design
4. Construction of model, simulator and platform
5. Production management of agriculture and stockbreeding
6. Database construction of C, CH_4 and N_2O balances
7. Remote sensing
8. Empowerment of local community

Theme Ⅰ	Development and evaluation of GHG absorption and fixation technology in forest ecosystems.
1a	Study of technological development for carbon fixation increase by systematic afforestation of arid land.
1b	Enhancement of CO_2 sinks by improvement of afforestation technology in tropical forest.
Theme Ⅱ	Management and assessment of control systems for emission of GHG from ecosystem at tropical peat swamps.
2a	Development of technologies for GHG source control and sink increase at tropical peat swamps.
2b	Studies on the option of land resources management and the empowerment for local community in the lowland swamp forest in Southeast Asia

Theme Ⅲ	Development and evaluation of new management options for improving GHG sink/source control in agricultural and forest ecosystems.
3a	Development and evaluation of mitigation technologies for CH_4 and N_2O emissions from agroecosystems
3b	New ecosystem management options for coping with enhanced CO_2 sink/source control and sustainable food production in the shifting-cultivation region of Southeast Asia.
Theme Ⅳ	Construction of integrated platform and common information system for promoting the research project

GHG sink potential (as Mt-C/20 years)

Afforestation technology (arid, tropical forests)		Management systems for tropical swamps	CH_4, N_2O source control	Management of shifting cultivation
1a	1b	2a,b	3a	3b
1,500	50 ～ 300	400 ～ 1,300	700 ～ 1,300	500
Total	3,200 ～4,900 Mt-C in 20 years (3% of present annual CO_2 emissions)			

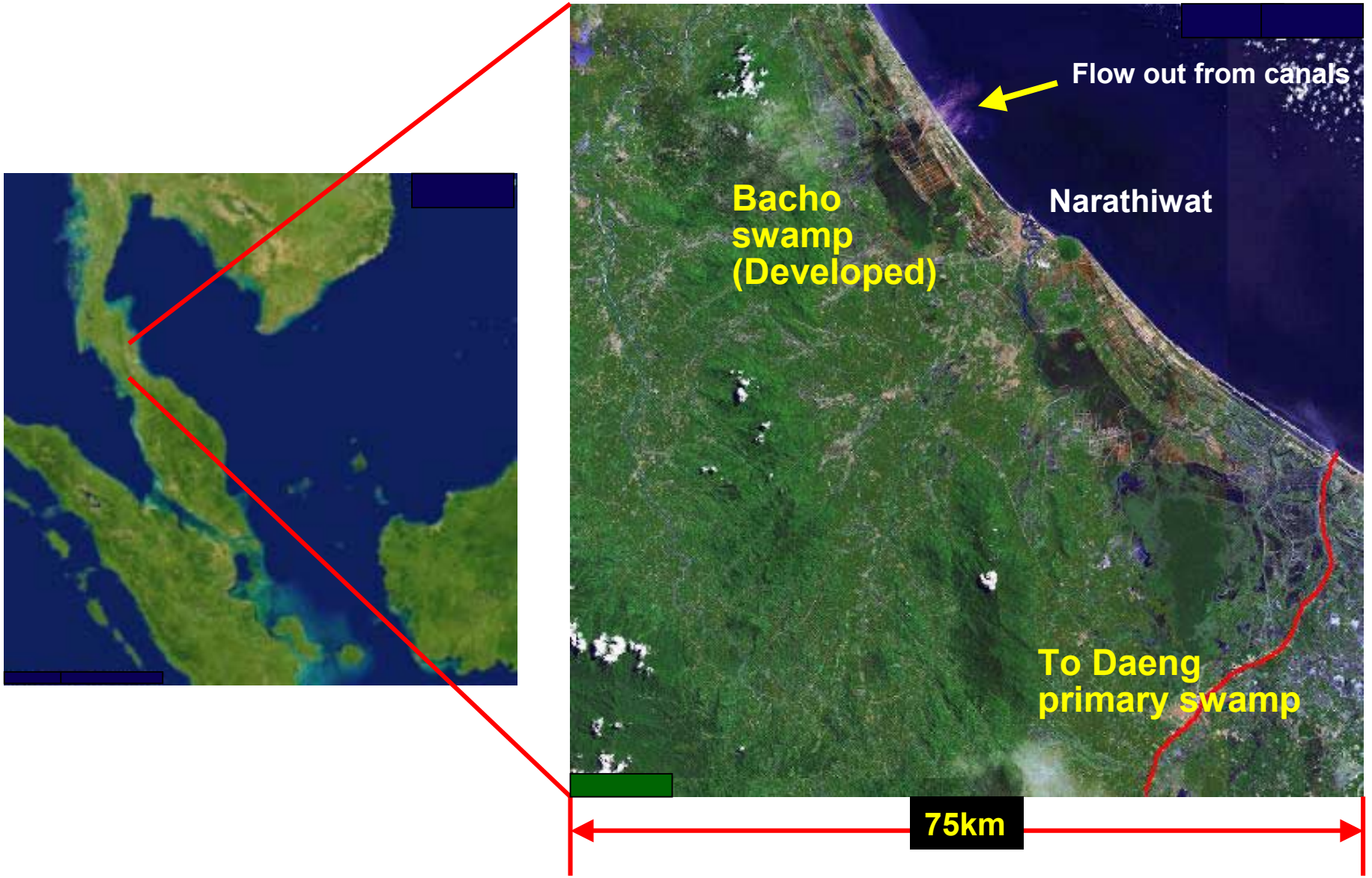
Distribution of tropical peat swamp

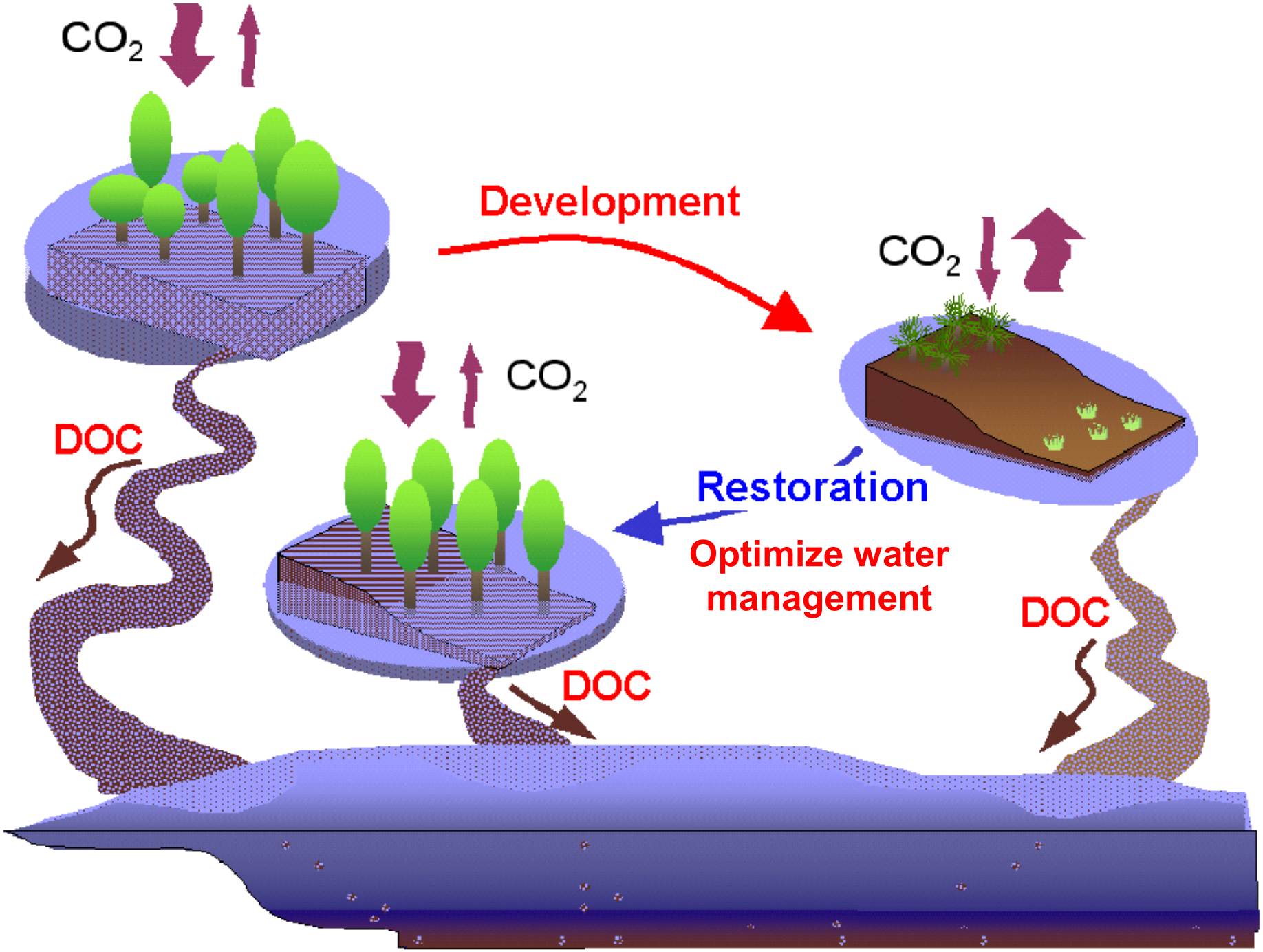
Distribution of tropical peat swamp in SE Asia (x 10^3 ha)

Region	Driessen (1978)	Yoshino et al.* (2006 unpublished data)	
	Swamp	Swamp	Bare land
Sumatra+Malay peninsula	10,500	7,950	1,780
Borneo (Kalimantan)	7,900	5,840	940
Irian Jaya	2,000	9,090	2,420
Mekong delta	300	-	-
Total	20,700	22,880	5,140

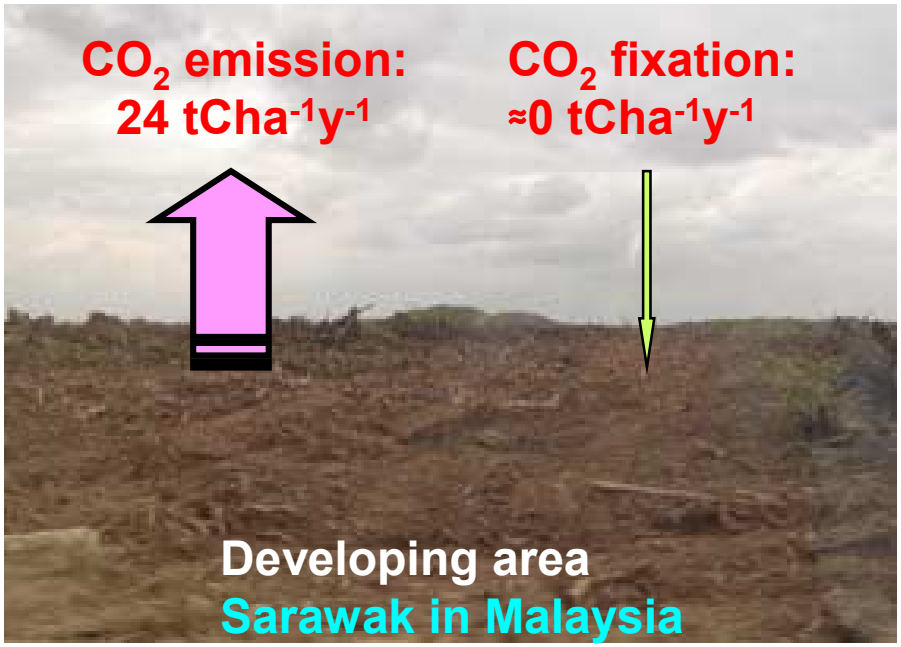
* Area was estimated using MODIS/NDVI and NOAA.

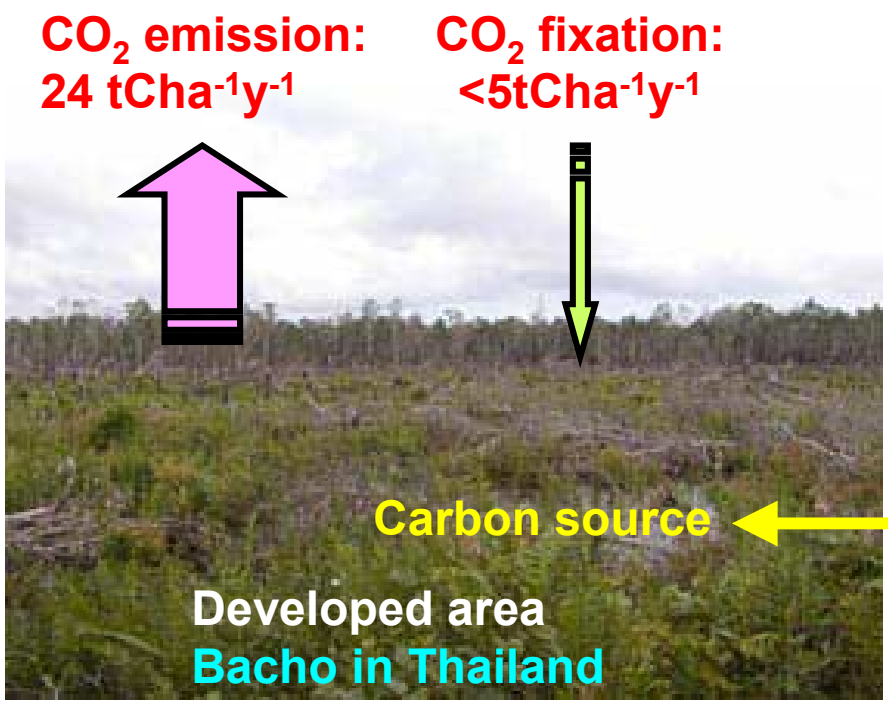
Tropical peat swamp at southern Thailand

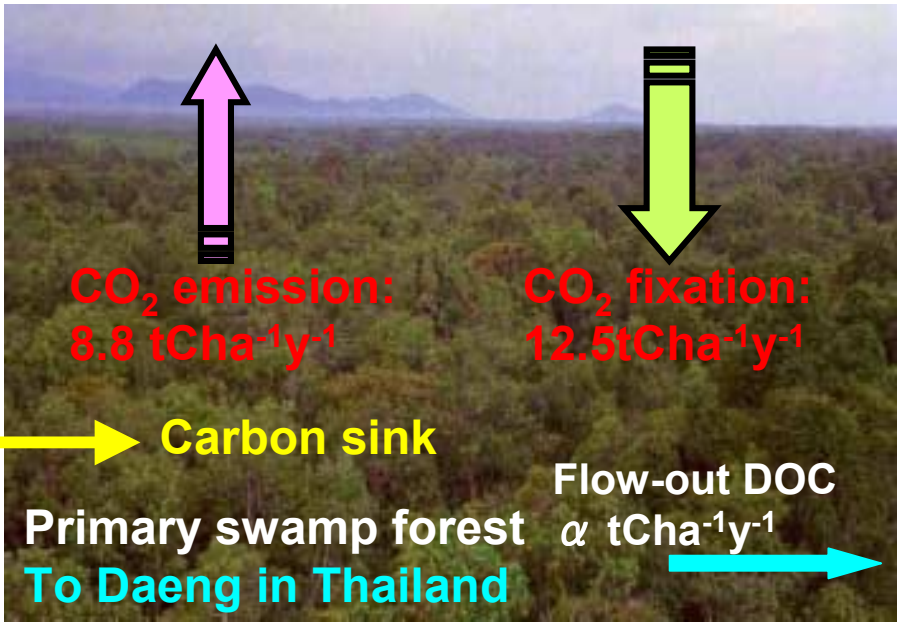



CO_2
Development
CO_2
CO_2
DOC
Restoration
Optimize water management
DOC
DOC

CO_2 fixation and emission from primary swamp forest and developed area

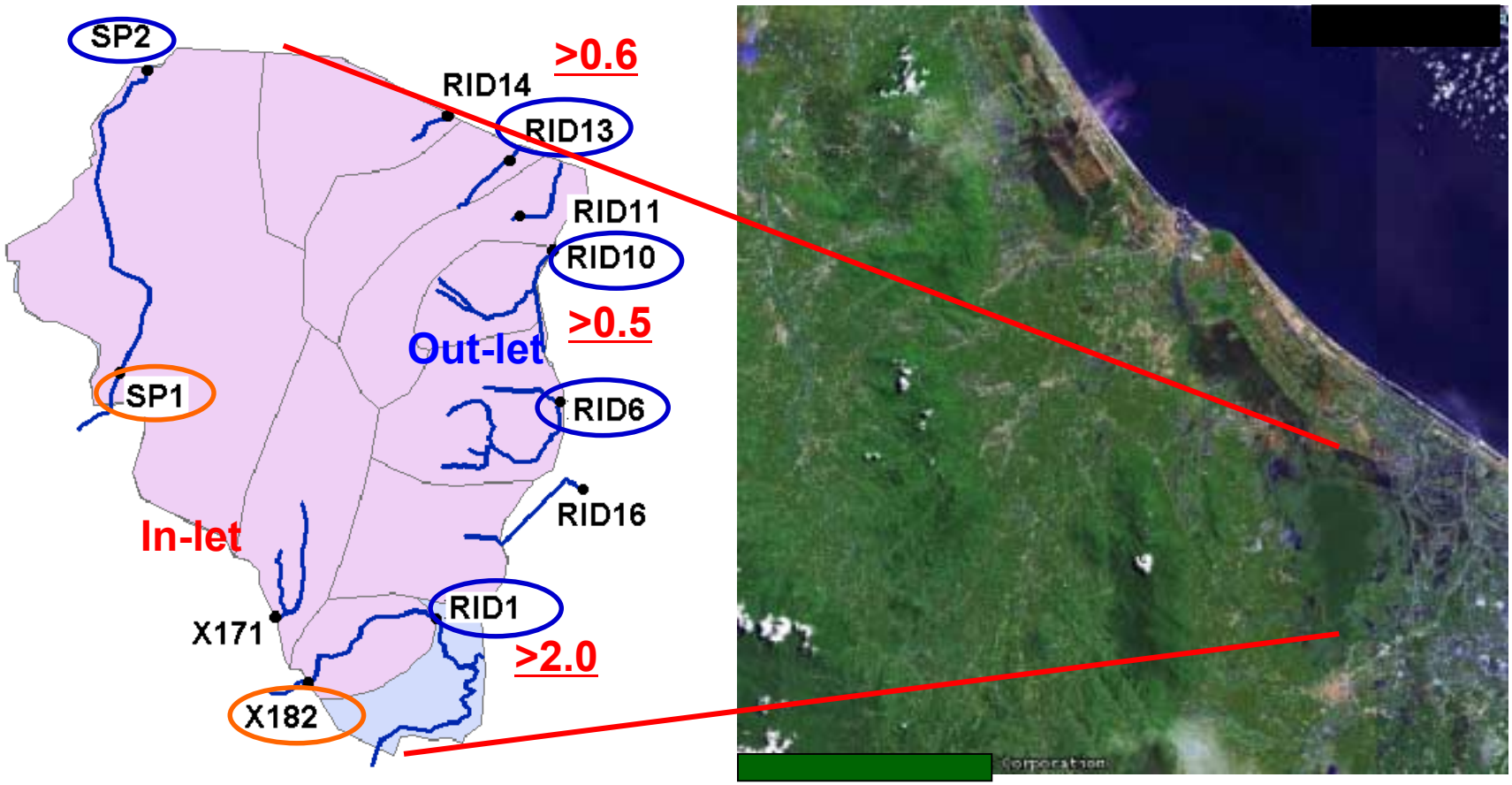






$\{(12.5-8.8)+(24-2)\} \times 5.14 \times 10^6 + \alpha$(Palm oil plantation) $= (132 + \alpha) \times 10^6$ tC

Flow-out dissolved organic carbon ($tCha^{-1}y^{-1}$) from primary peat swamp



Summary for investigation at peat swamp in Southeast Asia

1. Total area of peat swamp in SE Asia was estimated as 2,000-2,300x10^6 ha.
2. Bare land caused by land development of peat swamp was estimated as 5.14x10^6 ha in SE Asia. (Area of oil palm plantation is not clear yet.)
3. CO_2 emission from bare land was quantified as 24 $tCha^{-1}y^{-1}$.
4. Restoration of bare land by covering water and afforestation would be expected to increase carbon sink as 27 $tCha^{-1}y^{-1}$.
5. Significant amount of organic carbon was flow-out from peat swamp as “dissolved organic carbon” , of which major component was lignin being hardly decomposable by microorganisms.