

**PROPOSITIONS DE THEMES DE MEMOIRES DE FIN D'ETUDES**

(pour des étudiants en Biologie, Bio-ingénierie, Science environnementales, Géographie, Informatique, Sociologie et Economie qui seront en MA2 en 2011-2012, 2012-2013 ou 2013-2014)

**THEMES FOR THESIS PROPOSALS**

(for students in Biology, Bio-engineering, Environmental sciences, Geography, Informatics, Sociology and Economy that will be in their final Master year in 2011-2012, 2012-2013 or 2013-2014)

**Domaines de recherche :** Sciences multidisciplinaires, Biologie marine, Géographie, Biologie de la conservation, Ecologie de la mangrove, Ethologie des crabes, Ethnobiologie et socio-écologie/socio-économie.

**Research domains :** Multidisciplinary sciences, Marine sciences, Geography, Conservation biology, Mangrove ecology, Crab ethology, Ethnobiology and socio-ecology/socio-economy.

Promoteur/Promoter	Farid DAHDOUH-GUEBAS
Unité de Recherche Research Unit	Systems Ecology and Resource Management Écologie des Systèmes et Gestion des Ressources
e-	<a href="mailto:fdahdouh@ulb.ac.be">fdahdouh@ulb.ac.be</a> , <a href="http://www.ulb.ac.be/sciences/biocomplexity/">www.ulb.ac.be/sciences/biocomplexity/</a>
	02/650.21.37 – 02/629.34.22
Campus	Solbosch, Bâtiment B, Niveau 2 <sup>E</sup> , Bureau 65

Les étudiants sont invités de consulter le professeur pour discuter les particularités des sujets. Pour autant que possible les objectifs particuliers seront orientés vers les intérêts de l'étudiant. A la proposition des étudiants, on peut envisager aussi d'autres sujets. Les étudiants sont également encouragés de consulter les publications dans les revues internationales avec comité de lecture disponibles sur le site web du labo pour se former une idée de la recherche. Plusieurs thèmes nécessitent l'obtention d'une bourse de voyage telle que celles de la CUD (date limite = fin octobre).

Students are invited to consult the professor to discuss the particulars of the topics. If possible, the objectifs will be oriented towards the student's interest. If proposed by students, other topics may also be considered. Students are also encouraged to consult the peer-reviewed publications available from the lab's website to have an idea about the research. Several topics necessitate a travel grant award such as that from CUD (deadline = end October).

**THEME 1 :**

**Do planted mangroves develop like natural mangroves ? A case-study in the peri-urban mangroves of the city of Zhanjiang and in the Zhanjiang Mangrove National Nature Reserve (Guangdong, China).**

**Les mangroves plantées se développent-elles comme les mangroves naturelles ? Une étude de cas dans les mangroves péri-urbaines de la ville de Zhanjiang et dans le Zhanjiang Mangrove National Nature Reserve (Guangdong, Chine).**

**Objective :** The city of Zhanjiang has planted a small stretch of mangroves in front of the beach in the city centre. The study aims at assessing to which extent these planted mangroves are comparable to natural stands on the nearby island of Techeng. This is done from the viewpoint of tree development, faunal assemblages and environmental processes.

#### **THEME 2 :**

**A GIS approach using data from social and natural sciences to understand the global distribution of mangrove forests.**

**Une approche SIG utilisant des données des sciences naturelles et sociales pour comprendre la distribution globale des forêts de mangroves.**

Objective : This is a macroecological study that synthesizes the data available from global databases in a GIS to detect global patterns explaining the forest diversity, structure and extent mangroves.

#### **THEME 3 :**

**Does mangrove root complexity affect crab-propagule interaction ? An approach integrating animal foraging behaviour into geographical information systems.**

**La complexité des racines affecte-t-elle l'interaction entre crabes et propagules ? Une approche intégrant le comportement animal de fourragement dans des systèmes d'information géographique**

Objective : Animal behaviour is seldomly integrated in GIS platforms. Yet the spatial nature of foraging data makes their analysis very promising. In this study we investigate whether the presence of aerial roots affects the ability of crabs to compete for propagules. GIS-based energy cost calculations will be integrated into small-scale excursions from a home burrow to a particular food source.

#### **THEME 4 :**

**Comparison of the floral diversity and distribution of mangroves at Tumpat (east coast) and Matang (west coast) in Peninsular Malaysia using Quickbird imagery.**

**Comparaison de la diversité florale et la distribution des mangroves à Tumpat (côte est) et Matang (côte ouest) sur la péninsule de Malaisie en utilisant les images Quickbird.**

Objective : This study aims at analysing very high resolution imagery from multiple sites in Malaysia in terms of mangrove species composition.

#### **THEME 5 :**

**Le comportement alimentaire du crabe violoniste *Uca lactea annulipes* au Kenya et ses conséquences pour le fonctionnement de la forêt de mangrove.**

**The feeding behaviour of the fiddler crab *Uca lactea annulipes* in Kenya and its consequences for the functioning of the mangrove forest.**

Objective : Like many other crabs the fiddler crab *Uca lactea annulipes* aerates the hypoxic mangrove soil by its burrowing activities. However, also when feeding this filter feeder processes soil particles. This study aims at understanding what the crab eats exactly, and whether it gardens any microalgae as suggested by Bartolini *et al.* (2011).

## **THEME 6 :**

**La quête pour la description silvimétrique plus exacte d'une forêt : création de forêts virtuelles et simulations de différentes méthodologies phytosociologiques.**

**The quest for the most exact silvometric description of a forest : creation of virtual forests and simulations of different phytosociological methods.**

Methods to describe vegetation assemblages (plot-based method, nearest-individual method, nearest-neighbour method, point-centered-quarter method, and many others) often do not perform as we would expect and may generate error in the range of -100% to + 50%. This is highly problematic when investigating exploitable wood resources, biomass, carbon sequestration, etc...

Objective (for a student in biology, bio-engineering or computer science) : Using Matlab we would like to have a forest simulated from scratch, being in control of the following factors : proportion of the various species, clustering of the various trees with respect to each other, proportion of multiple-stemmed trees (MST), *i.e.* trees with 1 or more thicker central stems surrounded by a series of significantly thinner stems, clustering of various trees with respect to environmental features such as water bodies, distribution of tree diameters and finally the proportion, distribution, form and size of polygons representing the environmental features. Then scripts need to be implemented (partly written by Hijbeek, 2009) to integrate analysis of virtual forests using a variety of vegetation description methods.

Objective (for a student in computer science or civil/industrial/bio-engineering) : The task for this study is simply to produce an interface to create the above-mentioned virtual forests and apply the vegetation description methods.

## **THEME 7 :**

**Étude des changements paysagères dans les zones côtières chinoises utilisant des images optiques de télédétection : préservation des mangroves *versus* développement d'aquaculture.**

**Landscape change study in Chinese coastal areas using optical remote sensing imagery: mangrove conservation *versus* aquaculture development.**

Objective : This is a classical study design to investigate the recent conversions of certain land cover classes to aquaculture at the expense of natural habitats such as mangroves.

## **THEME 8 :**

**Development of mangrove forests planted as coastal protection in Sri Lanka.**

**Le développement des forêts de mangroves plantées comme une protection côtière au Sri Lanka.**

Objective : Almost a decade after the Indian Ocean tsunami the time has come to investigate the success of mangrove forests and other bioshields established as a coastal protection.

## THEME 9 :

**Investigating the status of 20 year-old mangrove plantations : floristic succession, faunistic recruitment, environmental processes and human uses.**

**Evaluation de l'état de plantations de mangrove âgés de 20 ans : succession floristique, recrutement faunistique, processus environnementales et utilisations humaines.**

Objective (Gazi, Kenya) : Since 1990 several plantations of *Rhizophora mucronata*, *Ceriops tagal*, *Avicennia marina* and *Sonneratia alba* have been established and monitored. This study marks a new monitoring session on the floristic succession, faunistic recruitment and environmental processes and investigates to which extent humans can sustainably use the plantations.

Objective (Pambala, Sri Lanka) : Since 1990 several plantations of *Rhizophora mucronata*, *Rhizophora apiculata*, and *Avicennia officinalis* have been established and monitored. This study marks a new monitoring session on the floristic succession, faunistic recruitment and environmental processes and investigates to which extent humans can sustainably use the plantations.

## THEME 10 :

**Emergent homing behaviour in the modeling of foraging of the mangrove crab *Thalamita crenata***

**Comportement homing émergent dans la modélisation du fouragement du crabe de mangrove *Thalamita crenata***

Objective : The swimming crab *Thalamita crenata* is an ambush predator that occupies mud flats and ancient coral reef flats in front of Kenyan mangrove forests. They have a home burrow that serves as refuge when water level is too high or too low, as a feeding or mating place and as a place where they act as ambush predators. A basic NetLogo model exists in which foraging metrics are given such as distance walked, direction to home burrow, etc. The idea is now to include various aspects of the crab's foraging habits in the model to check whether the model displays emergent behaviour. This necessitates the integration of : number of houses as a proxy for competition for space, adaptive learning using visual cues, variability in the length of the activity window (during in-coming and during out-going tide) between spring and neap tides, predation pressure (at low tide : predation by birds, at high tide : predation by fish), availability of prey and finally social interactions between crabs (when foraging, when feeding, when searching for a home).

This study is conducted in different phases. The first phase focused on excluding several types of random walks in the homing behaviour of *Thalamita crenata*. The second phase focused on field experiments trying to understand the cues used by the crabs to find back their home burrow. This third phase now focuses on further developing (partly written) the understanding of homing behaviour using individual-based animated models using the user-friendly NetLogo program in order to reproduce emerging crab behaviour.

## THEME 11 :

**Remote sensing of the northernmost mangroves along the West-African coast : which advantages do object-based classifications offer over pixel-based classifications ?**

**La télédétection des mangroves septentrionale le long de la côte d'Afrique de l'ouest : quelles avantages offrent les classifications *object-based* sur les classifications *pixel-based* ?**

Objective : This study assesses the possibility to use object-based classifications in order to detect and classify mangrove trees and stands consisting of a single species only. At the northernmost limit of Atlantic Africa this species is *Avicennia germinans*.

**THEME 12 :**

**Fragmentation of urban and peri-urban mangroves adjacent to the city of Recife, Pernambuco – Brazil, detected through a sequence of 35 years of Landsat, China-Brazil Earth-Resources Satellite (CBERS) and Quickbird imagery.**

**Fragmentation de mangroves urbaines et péri-urbaines adjacentes à la ville de Recife, Pernambuco – Brésil, détectée sur une série diachronique de 35 ans d'images de Landsat, du China-Brazil Earth-Resources Satellite (CBERS) et de Quickbird.**

Objective : Analysis of CBERS and Quickbird imagery to document the changes in the mangrove forest and the fragmentation of populations.

**THEME 13 :**

**Ethnobiology, valuation and management of mangrove forests.**

(Case-studies in different countries)

**L'ethnobiologie, la valuation et la gestion des forêts de mangroves.**

(Etudes de cas dans different pays)

Objective : This study is a socio-ecologic assessment of mangrove goods and services. Interviews with local inhabitants following long-standing questionnaires on utilization patterns, diversity, marketable species, and economic value are the basis for this research.

**THEME 14 :**

**Traditional human occupation in the natural reserve Parque Estadual da Ilha do Cardoso (southern littoral of São Paulo State – Brazil).**

**Occupation humaine traditionnelle dans la réserve naturelle du Parque Estadual da Ilha do Cardoso (littoral sud de l'État de São Paulo – Brésil)**

Objective : This study aims at evaluating the historic traditional human occupation (indians and caiçaras) in the Parque Estadual da Ilha do Cardoso (littoral south of São Paulo State, Brazil) before and after its establishment. This will be done by analyzing satellite images from Landsat TM 5 and CBERS-2B and by aerial photography, with analyses in a GIS.

**THEME 15 :**

**Mangrove canopy gaps caused by natural and human processes : a case-study in the southern littoral of São Paulo State – Brazil.**

**Des trous de canopée de mangroves déclenchés par des processus naturels et humains : une étude de cas dans le littoral sud de l'État de São Paulo – Brésil**

Objective : We aim at analysing the different canopy gaps within the mangrove forest of the Cananéia-Iguape coastal system, submitted to different natural and anthropogenic impacts.

**THEME 16 :**

**Reconstruction of the spatio-temporal dynamics of the mangroves of the Zhanjiang Mangrove National Nature Reserve (ZMNNR, Guangdong, China) using aerial photography**

**Reconstruction de la dynamique spatio-temporelle des mangroves du Zhanjiang Mangrove National Nature Reserve (ZMNNR, Guangdong, Chine) utilisant des photographies aériennes**

Objective : The ZMNNR comprises >60 patches of mangrove forest spread throughout the Leizhou peninsula. In addition multiple adjacent patches exist in neighbouring Chinese coastal provinces. We aim at selecting a number of patches and describing their spatio-temporal history using remote sensing and field work.

**Pour des étudiants avec un intérêt d'apprendre ou avec une expérience en programmation et intégration multidisciplinaire de données les sujets suivants sont disponibles :**

**For students with a learning interest or an experience in programming and multidisciplinary integration of data the following topics are available :**

Pour des étudiants avec un intérêt d'apprendre ou avec une expérience en programmation et intégration multidisciplinaire de données les sujets suivants sont disponibles :

For students with a learning interest or an experience in programming and multidisciplinary integration of data the following topics are available :

**THEME 17 :**

**Literature-based versus field-based testing of KiWi simulation output from Matang (Malaysia)**

Objective : The paper by Fontalvo-Herazo *et al.* (in press) applied KiWi simulations to literature data from 15-20 years ago. Using our field data from the natural forest, and from forests harvested after 15, 20 and 30 years, we can check whether the model output can be corroborated using field data.

**THEME 18 :**

**Building an ecologic-economic model to improve silvicultural management practices in Matang (Malaysia)**

Objective : Following the paper by Fontalvo-Herazo *et al.* (in press) and discussions with Dr. Cyril Piou we could build a model that includes labour cost for different silviculture-related activities such as seedling nursery care, plantation, pruning, thinning, harvesting, etc...) as well as prices of wood of different quality (related to pole diameter, length or straightness), other benefits and costs of natural/silvicultural stands (crab, fish, mussels catches), and possibly environmental hidden benefits such as carbon fixation and coast line protection.

**THEME 19 :**

**Testing 20 years of mangrove forest structure development in Gazi (Kenya) predicted by KiWi with field data**

Objective : Since 1990 several plantations of *Rhizophora mucronata*, *Ceriops tagal*, *Avicennia marina*, and *Sonneratia alba* have been established and monitored. We can use the KiWi to model the development of these monospecific stands planted at regular intervals and use field data on plant development and on (non-planted) floristic recruitment.

**THEME 20 :**

**Validating one decade of mangrove forest development using KiWi predictions and field monitoring**

Objective (microtidal site Galle-Unawatuna, Sri Lanka) : We have the exact position of mangrove trees from the years 1999-2004 and we can ask KiWi to predict forest development over 10 years and confront these with newly collected data. The site is microtidal in the sense that the spring tidal amplitude is <50 cm.

Objective (macrotidal site Gazi, Kenya) : We have the exact position of mangrove trees from the years 1999-2002 and we can ask KiWi to predict forest development over 10 years and confront these with newly collected data. The site is macrotidal in the sense that the spring tidal amplitude is up to 4 m.

#### **THEME 21 :**

##### **Testing the predictions of several decades of mangrove forest development using the KiWi model with remote sensing data from very high resolution remote sensing and fieldwork**

Objective (Galle-Unawatuna, Sri Lanka) : We have very high resolution remote sensing data from 1956, 1974, 1994 and 2004 based on which we can extract proportions of trees, and we can use fieldwork data to extract tree diameter distributions. Then we can ask KiWi to predict tree diameter distribution after 20, 40 and 50 years and confront these with the imagery and field data. The available images are aerial photographs and Ikonos satellite imagery and the site has been visited during fieldwork expeditions in 1997, 1998, 1999, 2002 and 2004.

Objective (Gazi, Kenya) : We have very high resolution remote sensing data from 1972, 1992 and 2002 based on which we can extract proportions of trees, and we can use fieldwork data to extract tree diameter distributions. Then we can ask KiWi to predict tree diameter distribution after 20, 30 and 40 years and confront these with the imagery and field data. The available images are aerial photographs and Quickbird satellite imagery and the site has been visited during fieldwork expeditions in 1993, 1995, 1997, 1999, 2000, 2003, 2005, 2007 and 2009.

#### **THEME 22 :**

##### **Comparison of tree growth functions to integrate in the KiWi model : a case-study on simulations and real data from 20 year-old monospecific plantations in Gazi (Kenya)**

Objective : The monospecific plantations we have studied in Kenya and Sri Lanka represent a simple starting situation for the KiWi model (in fact it is one of the tasks in tutorial 6) about which we have lots of data, as we have 2 consecutive PhDs and many other studies that followed these plantations very closely. Our data can be used to optimise several species' growth functions, and while we are at it, we could integrate Uta's idea on comparing a number of growth functions other than that of Botkin *et al.* (1972).

#### **THEME 23 :**

##### **Parametrising trees of which the diameter at breast height cannot be measured at breast height**

Objective : We can start using data from trees that can be measured at breast height (*i.e.* at 130 cm above the soil and along the stem) by using our data from Cameroon in which we measured the diameter of *Avicennia germinans*, *Laguncularia racemosa* and three species of *Rhizophora* (*Rhizophora racemosa*, *R. harrisonii* and *R. mangle*) at every 10 cm of height; so  $D_{020}$ ,  $D_{030}$ ,  $D_{040}$ ,... up to  $D_{130}$  *sensu* Brokaw & Thompson (2000). This would give us a good baseline of the variation of results with diameters that are or are not taken at the right position. Then we can move to data from *Ceriops tagal* and *Aegiceras corniculatum* in which measurements taken at 130 cm height often makes no sense at all if one considers the architecture of the tree.

#### **THEME 24 :**

##### **Using object-based classification of very high resolution remote sensing imagery (aerial, Ikonos, Quickbird and GeoEye-1 images) to extract information on stem positions in both forests with discontinuous and continuous canopies**

Objective : KiWi works (best) with stem position information, which necessitates large field data sets (which we have) or remotely sensed stem positions. However, remote sensing imagery can only provide stem position information in areas where single crown can be easily recognised and linked to the position of the stem. We can use our data from areas where single trees are recognisable (at high latitudes such as in Mauritania, in landward zones in multiple sites,...) and see how crown shapes link to stem position. In a second step we can try to find individual crowns in forests with a closed canopy (at lower latitudes, in the mid-intertidal). Then we can see if we can use KiWi to reproduce the current canopy structure based on stem position data. VHR satellite imagery is available from Mauritania, Gambia, Mozambique, Tanzania, Kenya, Sri Lanka and China.



#### **THEME 25 :**

##### **Development of isolated trees at the northernmost limit of mangroves along the West-African coast**

Objective : The Parc National du Banc d'Arguin (PNBA) marks the northernmost limit of the distribution of *Avicennia germinans* along the Atlantic coast of Africa. Trees grow in one of four typical formations : isolated trees higher than wide (max. height = 4 m), isolated trees wider than high (or at least nearly as wide as high, max. height = 1.5 m), shrub (tree aggregates of max. 2 m high) and sebkha (isolated flowering "bonsai" trees of max. 50 cm high amongst halophyte herbaceous vegetation in landward depressions reached only during spring or equinoctial tides). Since these forms (maybe 'ecotypes') can be clearly distinguished in the field there must be some way to parametrise KiWi in such a way that these patterns are reproduced. The advantage of studying this site is that data are available from two field expeditions (1998 and 2009), and that XY positions are either not needed (no overlapping FONs) or that they can be extracted from the VHR imagery (Quickbird) that is available (even for the aggregated shrub formations).

#### **THEME 26 :**

##### **Integrating very high resolution digital terrain models in the KiWi model to forecast mangrove dispersal under increasing sea-levels**

Objective : This aims at forecasting colonisation by mangroves and can be subdivided into several case-studies applicable to multiple sites (*Rhizophora-Ceriops*-dominated or *Xylocarpus*-dominated stand in macrotidal sites in Gazi, Kenya, *Excoecaria*-dominated microtidal stand in Galle-Unawatuna, Sri Lanka, as well as two bay-wide macro-or microtidal DTMs of lower resolution).

#### **THEME 27 :**

##### **Pruning or thinning a planted mangrove forest ? A case-study using KiWi to predict the effect of various forest management options.**

Objective : The plantations we have studied in Kenya and Sri Lanka have been monospecifically planted in the early 1990s using fixed intervals. We have the data on how these forests developed. Whereas the Sri Lankan plantations have been left to grow without any management whatsoever and do not look very well (see left photograph) our Kenyan counterparts (see papers by Kairo *et al.* and Bosire *et al.*) have looked after various management options such as thinning and pruning half of the plantation. We also know which non-planted species were recruited at which time intervals. Using KiWi we could investigate the development of such a planted forest with or without recruitment, with or without pruning and with or without thinning. Since the starting situation is really simple we might even use our data to optimise the *Rhizophora* growth function.

#### **THEME 28 :**

##### **Mangrove species zonation : how ? Reproducing zonation patterns using environmental and vegetation data**

Objective : This topic combines ideas from Uta Berger & Farid Dahdouh-Guebas and aims at testing how zonation patterns (or vegetation structure pattern for that matter) can emerge based on the autoecology of a plant species alone (recruitment, growth, death), on the interaction between plants (intra- and inter-specific competition), on the interaction between plants and the environment (salinity, nutrient availability,...), and on the interaction between plants and animals (propagule predation by crabs or other animals). We can use the KiWi model and base all simulations on a wide variety of data that we possess or that we generate artificially.

**THEME 29 :****Simulating the future development of the XXX mangrove forest using the KiWi model**

Objective : Using the same table as indicated above, we can model the future development of the forest in our study sites. Not all our study sites have as complete data sets, but we have data from several sites ('XXX' in the title) in Mexico, Colombia, Brazil, Mauritania, Gambia, Cameroon, Mozambique, Tanzania, Kenya, India, Sri Lanka, Malaysia, Vietnam and China. This is the type of research topic that you can endlessly repeat in a wide variety of sites. Whereas in many sites it may not be more than a descriptive study (not frontier science !), in the sites from which we have the longest field-work experience (ca. 20 years) it may be very welcome to have such a prediction, and summed over multiple sites on all continents it may help us to give a more solid sense to the *Science* paper 'A world without mangroves' (Duke *et al.*, 2007), especially if we apply particular scenarios to the forest development. The variability in scenarios multiply the number of case-studies we can investigate using such studies even more, but the scenarios can also be based on the long-term socio-ecological data we have collected.

**THEME 30 :****Investigating the gain and loss of the coastal protection function of mangroves against ocean surges : a modelling approach using different species compositions, densities and diameter distributions of mangrove trees in the KiWi model**

Objective : The work PhD student Nibedita Mukherjee is doing with Nico Koedam and Farid Dahdouh-Guebas, is definitely an example of how we should further investigate what a mangrove really is, how the genesis of a mangrove occurs, how functions in a mangrove arise, and how functions are lost. The latter two can be easily exemplified when focussing on the protection function of mangroves. Concepts such as 'cryptic ecological degradation' and 'ecological redundancy' stand central in that type of research. How many terrestrial plants may invade the mangrove forest at the expense of true mangrove species before the protection function is lost ? How many species or redundant species do we need before a protection function is gained and consolidated ? The natural tsunami "experiment" provided in part an answer to that.

**THEME 31 :****Investigating the vulnerability of *Ucides cordatus* to changes in mangrove forest composition, structure and extent**

Objective : One of my new PhD students is focusing on the spatial-temporal analysis of mangrove habitats and *Ucides cordatus* yield in the São Francisco River Estuary (State of Sergipe, Northeast Brazil). This study can be translated into a logical follow-up of the individual-based-*Ucides* model (IBU) by Piou *et al.* (2007) with links to crab foraging and fisheries management.

**THEME 32 :****Impact of *Neosarmatium meinerti* and *N. smithii* on mangrove regeneration in Kenyan mangroves : modeling interactions amongst crabs and propagule predation in function of leaf and propagule availability**

Objective : Following the individual-based-*Ucides* model (IBU) this topic would focus on making an individual-based-*Neosarmatium* model (IBN). *Neosarmatium meinerti* and *N. smithii* are the main propagule predators in many paleotropical mangrove forests (other propagule predators from our study sites are *Sesarma guttatum* and *Episesarma tetragonum*). It has always been my dream to connect the development of the forest using our long-term data and KiWi to the behaviour of crabs. Both can be modeled using an individual-based approach. this is probably one of the most complicated research topics.

**THEME 33 :**

**Foraging behaviour in *Uca lactea annulipes* in Kenyan mangroves : spatial analysis of home ranges, feeding pellet depositions and selfish herds**

Objective : The fiddler crab *Uca lactea annulipes* occupies open sandy areas in Kenyan mangrove forests. They have a home burrow, the spatial patterns of which are interesting to be analysed in function of their foraging behaviour. One of these behaviours is the processing of soil particles (they are filter feeders) and the deposition of these using characteristic patterns around the home burrow. Another behaviour is the emergence of selfish herds that aim at raiding new burrows and finding more suitable places to live, but also for feeding and for searching a mating partner. Needless to say that these crabs have highly developed ways of communication using vision (and sensing soil vibrations resulting from hitting the soil with the large chela). Interactions between these crabs are very strong. This topic will aim at reproducing and predicting various aspects of the crab's behaviour.

References : Please consult our papers on the website and the full citations therein.

## **Rough description of the laboratory's research topics**

- Vegetation structure dynamics : remote sensing + GIS + ground truth
- Explanatory environmental and human factors
- Vegetation studies : propagule features (fall, buoyancy, dispersion)
- Plant-animal interactions : propagule predation, brachyogamy (?), pathogens destroying mangrove leaves or roots
- Ethology : fiddler crab behaviour (feeding pellets, micro-algae), crab orientation behaviour
- Socio-ecologic questionnaires : utilization, perceptions on change, governance issues, ecotourism potential
- Restoration ecology : development, secondary succession, faunistic recruitment
- Mangrove Reference Database and Herbarium : macro-ecology of mangroves, socio-economic and climatic country features, species distributions, biogeography, identification tools, historical analyses
- Global change biology : sea-level rise, propagule dispersion in mangroves, colonisation
- Natural hazards : land-based soil-erosion, tidal erosion, El-Niño rains, hurricanes, ocean surges (from hurricanes, from tsunamis), coastal protection by mangroves
- Silvometric description of a forest : creation of virtual forests, comparison of vegetation description methods
- Functionality of mangroves : functionality of mangrove trees (ecological and socio-ecological goods and services), functionality of the mangrove ecosystem (ecological functions)

## **Description des thématiques de recherche du labo**

- Dynamique de la structure de la végétation : télédétection + SIG + réalité du terrain
- Facteurs environnementaux et humains explicatifs
- Étude de la végétation : caractéristiques des propagules (détachement de l'arbre, flottation, dispersion)
- Interactions plant-animal : prédation de propagules, brachyogamie (?), pathogènes détruisant les feuilles ou les racines des palétuviers
- Ethologie : comportement des crabes violonistes (boulettes de nutrition, micro-algues), orientation des crabes
- Questionnaires socio-écologiques: utilisation, perceptions de changements, sujets de gouvernance, potentiel d'écotourisme
- Écologie de la restauration : développent, succession secondaire, recrutement faunistique
- Mangrove Reference Database and Herbarium : macro-écologie des mangroves, socio-économie et caractéristiques climatiques des pays, distributions d'espèces, biogeographie, logiciels d'identification, analyses historiques
- Biologie du changement global : augmentation du niveau de la mer, dispersion des propagules dans les mangroves, colonisation
- Catastrophes naturels : érosion du sol, érosion par les marées, pluies El-Niño, ouragans, ondes océaniques (d'ouragans, de tsunamis), protection côtière par les mangroves
- Description silvométrique d'une forêt : création de forêts virtuelles, comparaison de méthodes de description de la végétation
- Fonctionnalité des mangroves : fonctionnalité des palétuviers (biens et services écologiques et socio-écologiques), fonctionnalité de l'écosystème de la mangrove (fonctions écologiques)