



**School of Marine Affairs  
College of Ocean and Fishery Sciences**

***Human Dimensions of Global Change Affecting the Marine Environment***

**A Proposal to Redesign the Master of Marine Affairs Curriculum**

**October 2007**

**Approved by the Graduate School**

**for implementation in Academic Year 2008-09**

**School of Marine Affairs**  
**A Revised Masters' Curriculum That Addresses**  
***Human Dimensions of Global Change in the Marine Environment***

**Summary of Proposed Changes**

Degree Name: Remains the same, Master of Marine Affairs

Revised SMA Mission Statement: The faculty feels these proposed changes warrant revision of the School's Mission Statement. The revised statement adopted in AY 2006-07 is:

The mission of the School of Marine Affairs is to provide leadership and training to address contemporary and emerging issues in marine systems, especially those associated with the human dimensions of global change. We equip students with the professional and analytical skills necessary to solve complex, interdisciplinary problems and recognize opportunities in marine systems. Through student training, applied research, and service to the broader community, SMA faculty and students make significant contributions to government, nongovernmental organizations, and industry. [Underscore indicates revised portion.]

Introductory Sequence: A new required four-course introductory sequence introduces *Human Dimensions of Global Change in the Marine Environment* (HDGCME) as a basic framework to guide masters-level study in Marine Affairs. The courses explore: 1) the utility of conceiving of human and environmental systems as coupled and interacting in a dynamical way (SMA 500); 2) ways that change in either subsystem can be identified, assessed, and related to change in other subsystems (SMA 501); 3) analytic tools that support policy-related assessments within an HDGCME framework (SMA502); and 4) relationships between modes of assessment and modes of action, including the varied formal and informal institutional frameworks that support decision-making, evaluation, and adjustment in addressing contemporary marine problems (SMA 503).

Programmatic Learning Objectives: Students learn:

1. The broad spectrum of marine affairs issues trends, problems and institutions.
2. How to do analyses which facilitate understanding of HDGCME via change detection and analysis, integrated assessment, policy analysis, and risk and vulnerability assessment and management.
3. How to bridge the natural and social sciences, including law and policy studies, in the performance of Objective 1.
4. How to produce a professional or scholarly paper for publication.
5. How to communicate effectively with and influence practitioners and constituencies.

Two-Track System for Graduation Retained: SMA retains its master's thesis requirement and also its non-thesis option that was initiated in 2005.

Graduation Requirements: The credit requirement for graduation remains 59 credits. Upon approval by the Graduate Program Coordinator, non-thesis students substitute 10 credits of directed electives in lieu of thesis (9) and thesis presentation (1) credits. Students in both tracks are encouraged to avail themselves of graduate certificate programs offered by other units and to use elective credits to develop ancillary skills suited to their individual research and professional objectives.

Thesis Direction: A new system of individual faculty-led research seminars is intended to lead to earlier initiation of student thesis work and more time for students to carry their work through to professional publication.

### **Rationale**

Need to Refocus Curriculum: SMA's 10-Year Review Committee (2005-2006) recommended that the SMA faculty "craft a forward looking vision for both research and training...guided by [consideration of] the most likely critical marine policy issues of the next decade [and the] disciplinary skills, research and training...most helpful to addressing those policy needs". It thought such a vision should take advantage of the School's existing strength in "human dimensions". The Graduate School Dean concurred, and in her April 3, 2006 memorandum to the Provost that marked culmination of the review she noted, "Current strengths and emphases in the School are well suited to refocusing the academic program around the theme of *human dimensions of global change in the marine environment*, as proposed by the Director."

Student Needs: Alumni and students who informed development of SMA's 2005 *Self Study* or who otherwise participated in the School's 10-Year Review emphasized the value of interdisciplinary training, analytical and communication skills, broad exposure to marine affairs policy and management issues, and skill at translating science to inform policy. They pointed especially to the importance of broad social science understanding—aka *human dimensions*—as it relates to contemporary marine policy and management issues. To paraphrase what a number of our student and alumni commentators said, "Knowing the science is important, but by itself it isn't enough."

The Review Committee noted that the School currently delivers well on all these educational objectives. At the same time the School needs to craft a unifying and forward-looking vision that preserves existing educational strengths while assuring that future marine affairs practitioners are able to cope with unprecedented new challenges. The term *global change* embodies well the key challenges the marine environmental managers and policy makers of the 21<sup>st</sup> Century will face.

Emerging Trends and Needs in the Field: The condition of the environment—at scales ranging from the local to the global—is emerging as one of the key concerns of the 21<sup>st</sup> Century. Global climate change, the impacts of globalization on society and the environment, and a variety of

cumulative effects associated with the resource demands of a growing human population—particularly in coastal areas—are increasingly evident at regional, national and global scales. These three phenomena in their aggregate constitute *global change*. The world’s oceans and coastal zones are especially vulnerable and also emblematic of many of the most important forces contributing to global change. Many if not most of the world’s largest cities are located in coastal areas and they often embody extremes of poverty and wealth that are problematic for the health of ocean and coastal resources, each in its own way. According to a recent study conducted at Columbia University, a tenth of the total world’s population now lives in low-lying coastal areas at risk from sea-level rise and other impacts of climate change. Most live in coastal “mega-cities”.

The drivers of environmental and societal change operate in concert and it is increasingly evident that their interactions must be accounted for if policy responses are to effectively address the longer-term aspects of non-sustainable use of marine and coastal resources. Graduate preparation for marine affairs practitioners should convey tools for systematic understanding and deconstruction of the interactions between human and natural-world marine environmental systems that generate social and environmental impacts. Practitioners must be prepared to use diverse approaches and tools, as governance and institutional failures are widespread. Traditional environmental regulation is increasingly being supplemented or replaced by such alternative models as public-private partnership, industry self-regulation, market-based mechanisms, community-based resource management, and the variety of approaches that now comprise “ecosystem-based management”.

At the same time, even as feedbacks between natural-world and social and institutional systems seemingly become more powerful shapers of human and the planet’s destiny, these forces remain poorly understood and poorly accounted for by today’s management approaches. The ineffectiveness of current institutional and governance approaches at achieving sustainability in the face of a whole suite of anthropogenic drivers of change affecting ocean and coastal realms has been highlighted in recent high-visibility reports of the Pew Oceans Commission (*America’s Living Oceans: Charting a Course for Sea Change*, 2003), the U.S. Commission on Ocean Policy (*An Ocean Blueprint for the 21<sup>st</sup> Century*, 2004), and the United Nations Millennium Ecosystem Assessment (*Living Beyond our Means: Natural Assets and Human Well Being*, 2005). The School of Marine Affairs, long a leader in the field of Marine Affairs, is proposing a new masters’ curriculum built upon the theme of *human dimensions of global change in the marine environment* (HDGCME) to better equip future practitioners to address these emerging needs.

## Core Course Sequence

The centerpiece of the new curriculum is a proposed new four-course core sequence, totaling 12 credits and required of all students. The first course, SMA 500, is a redesign of SMA's current required introductory course, Introduction to Marine Affairs. Credits are reduced by one and the course is re-titled *Introduction to Human Dimensions of Global Change in the Marine Environment*. The other three proposed courses are new: SMA 501, *Understanding Change in Natural and Social Systems*; SMA 502, *Assessment Methods for Human Dimensions of Global Change in the Marine Environment*; and SMA 503, *Marine Policy Action Taking, Implementation and Evaluation*. Each is 3 credits and the full sequence is intended to be taken in the first year of SMA's two-year masters program.

SMA 502 expands upon themes originally introduced to the curriculum in 2002 under the name Integrated Assessment Practice (originally SMA 501—but course number proposed for reassignment as above). The new SMA 501 is intended to underscore the need to recognize and address the dynamics of change in complex coupled nature-social systems. SMA 503 serves two purposes: First, it presents in a systematic way the frameworks and tools important to marine environmental problem solving in all relevant contexts—domestic as well as international, local as well as multi-regional, and formal as well as informal institutional arrangements. Second, it “closes the loop” on the policy problem life cycle that begins with problem anticipation and identification (SMA 500, 501), proceeds to assessment and the crafting of policy interventions (SMA 502) and ends with policy implementation, evaluation and adjustment (SMA 503). All courses will be team taught and the entire SMA faculty will be engaged in teaching the core sequence. Team teaching to this extent is new to SMA.

## Elaboration of Learning Objectives

### 1. Broad Understanding

Develop a broad understanding of the “field” of marine affairs as an inter-discipline:

- Understand the historical evolution and current trends in patterns of human use of the global marine environment, marine ecosystems, and the impacts thereof.
- Understand the ways in which the marine environment and ecosystems constrain or enhance human objectives and activities.
- Learn how to identify and interpret change in marine social and natural environmental systems.
- Learn how to assess sensitivities, vulnerabilities, adaptive capacity/resilience to single and multiple stresses which arise out of the dynamic relationship between humans and natural systems in the world ocean.
- Understand the ways in which authority to manage human activities in the world ocean is distributed at different spatial scales (local, sub-national, national, regional-international, global).

- Understand formal vs. informal approaches to marine environmental management and policy making and contexts appropriate to each.
- Understand how tools of marine environmental management relate to broader frameworks in which marine environmental problems are defined.
- Learn roles of policy and program evaluation and adjustment in broader context of marine environmental management and policy.

## **2. Disciplinary Knowledge**

- Advance abilities in specific disciplinary areas, with emphasis on relevant natural science and “human dimensions” areas.
- Become conversant with the concepts and terminology of natural science, social science (with emphasis on economics, law, political science, institutional analysis, anthropology, and sociology) and interdisciplinary studies (with emphasis on policy studies, policy analysis, science/technology studies)
- Learn to identify the role of various disciplines in the study of marine policy, resource management, and environmental protection
- Learn to integrate multiple types of information, tools, methods, and scholarship from these basic disciplines in the performance of “integrated assessments”.

## **3. Perform Analyses**

- Learn to perform quantitative and qualitative analyses to inform studies of HDGCME.
- Learn to incorporate uncertainty in analysis and decision-making.
- Learn various forms of multi-disciplinary assessment, including risk and vulnerability assessments and multi-criterion analysis.

## **4. Policy Identification, Evaluation, & Implementation**

- Develop the capacity to conceive of and evaluate alternative approaches to policy development and management in the face of changing suites of problems and across different institutional settings.

## **5. Connecting Between Disciplines: Integrated Assessment**

- Develop the capacity to participate in teams whose focus is detecting and explaining processes of change in the dynamic relationships of human social systems and natural systems in the marine environment. This capacity requires the ability to link the structure and dynamics of social systems, marine ecosystems, the marine environment, and external forcing functions of both human social systems and marine ecosystems. In addition, the ability to identify nonlinearities and thresholds in processes of change is of particular importance.

## 6. Communicating to a Variety of Audiences

- Learn to communicate effectively with a broad range of audiences and the general public, through a variety of modes, including, but not limited to, oral presentations, community meetings, written reports, and scientific publications.

### Other Curricular Changes of Significance

- The 3-credit thesis methods class, presently taken by thesis-track students in the 3<sup>rd</sup> quarter of their first year, is replaced by multiple faculty-led, one-credit seminars that run throughout the AY. The intent is that students will start thesis work earlier through on-going, small-group interaction and thus have more time and incentive, and richer results, which lead to publication.
- At student request, the first quarter thesis-methods seminar is comprised of weekly individual faculty-member presentations of their research interests, so that matches of students with faculty mentors can be more fully informed than they are at present.
- Students who waive the SMA introductory micro-economics requirement (SMA 536) are no longer required to take both the policy analysis core course (SMA 519) and one of SMA 537, 538, applied economics classes, reducing core requirements by three credits for many students.
- SMA's qualitative requirement is dropped, but students will be strongly encouraged to take as elective credits at least one of SMA 476 (Environmental Law Process) SMA 512 (Interviewing), or various other courses across campus on survey or other social research, as appropriate to the particular methodological orientation of their thesis work.
- SMA's quantitative requirement (basic statistics) is retained, but entering students are strongly encouraged to complete the requirement before entering the program.
- Total elective requirements are reduced as necessary to keep total graduation requirements to 59 credits.
- An elective, one-credit 'Current Events' Seminar, introduced at the request of students in AY 2006-07, is retained.

### ***Human Dimensions of Global Change in the Marine Environment: Required Introductory Sequence Elaborated***

Four courses, one a significant revamp of SMA's current introductory course (with a reduction in credits from 4 to 3), the other three new, comprise SMA's proposed new introductory sequence. These are SMA 500, 501, 502, 503. SMA retains core requirements in policy analysis, policy process, law, economics, and quantitative skills subject to provisos noted elsewhere. The current qualitative skills requirement is dropped and many students will be able to bypass either the policy analysis or economics requirement by dint of prior preparation.

1. *Introduction to Human Dimensions of Global Change in the Marine Environment* (SMA 500 3cr.) (Formerly *Introduction to Marine Affairs* (4 cr.)) Introduces the idea of global change from both natural and social scientific perspectives, emphasizing "human dimensions" aspects. Introduces the dynamical relationships that connect human- and natural-world systems and that underlie various types of global change (global climate

change, globalization, and cumulative environmental and/or social impacts). Explores ways understanding of human-environment interactions can assist decisions affecting environmental processes and their societal outcomes. Introduces the primary marine affairs domains together with problems and opportunities in each. Introduces the public and private—and national, regional and local—institutions and governance structures in place to realize opportunities, to manage intra- or cross- domain impacts, or both, together with their capacities and limitations.

2. *Understanding Change in Natural and Social Systems* (SMA 501 3 cr.) Provides a conceptual basis for understanding causes and consequences of change in natural and social systems. Explores differences between change and variability in natural and social systems and the importance of such differences to policy and decision-making. Explores methods for detecting change at various temporal and spatial scales and in natural and social domains. Explores cause-effect relationships in change analysis, and institutional barriers to conducting relevant assessments and applying results to policy making. Establishes change detection as a critical antecedent to integrated assessment.
  
3. *Assessment Methods for Human Dimensions of Global Change in the Marine Environment* (SMA 502 3 cr.) Presents principal analytic techniques relevant to understanding and managing HDGCME and associated impacts, including risk and vulnerability analysis, integrated assessment, cumulative effects and multi-stressor analysis, and ecological and carbon “footprint” analysis. Examines conceptual bases of main tools and includes consideration of effects of non-linearities and thresholds in analysis. Examines tools that assist analysis of both adaptation and mitigation strategies with respect to impacts of global change. Examines approaches to incorporating analysis into decision-making, and the roles institutional and cultural setting play in determining the influence of analysis as a problem solving tool.
  
4. *Marine Policy Implementation: Action Taking and Evaluation* (SMA 503 3 cr.) Aims to “close the loop” on recognizing the potential for worrisome change as a product of the dynamic interaction between human- and natural-world marine environmental systems (SMA 500, 501); analyzing causes, consequences and options for addressing impacts (SMA 502); and the policy- and decision-making, implementation, evaluation, and adjustment that must follow for effective response to problems that emerge within the HDGCME framework. Examines both formal and informal approaches to policy making and action taking, and both domestic and international frameworks, as well as the different dynamics that emerge when working in these differing contexts. Explore the dependency of tools for problem solving on the frameworks in which they are applied, and the conceptual models available to explain policy success.

### **Degree Requirements**

SMA proposes to begin introducing its new curriculum in AY 2008-09. SMA would offer existing classes as well as the new four-course introductory sequence (three new classes, plus a re-vamped SMA 500; Table 1).

**Table 1. School of Marine Affairs Course List<sup>1</sup>**

Course No.	Course Name	Cr.	Qtr.
<b>REQUIRED INTRODUCTORY SEQUENCE</b>			
SMA 500	Intro to Human Dimensions of Global Change in the Marine Environment (HDGCME)	3	Au
SMA 501	Understanding Change in Natural and Social Marine Systems	3	Au
SMA 502	Assessment Methods for HDGCME	3	Wi
SMA 503	Marine Policy Implementation: Action Taking and Evaluation	3	Sp
<b>OTHER COURSES THAT SATISFY CORE REQUIREMENTS</b>			
LAW B561/ SMA 506*	International Law of the Sea	3	Au
SMA 507 (joint-listed with PB AF 538)/ SMA 508	Int'l. Orgs. and Ocean Mgt./ Nat'l. Marine Policy Process	3	Sp
LAW B565/ SMA 515**	U.S. Coastal & Ocean Law	4	Sp
SMA 519	Marine Policy Analysis	3	Sp
SMA 521/523	Govtl. Responses to Climate Change/Int'l. S&T Policy	3	Au
SMA 536	Applied Microecon. for Marine Affairs	3	Au
SMA 537/538/ Econ 538	Econ. Aspects of Marine Policy/Econ. of Living Marine Resources	3	Wi
SMA 600	Independent Study/Thesis Seminar	3	All
SMA 570	Thesis Presentation	1	All
SMA 591	Marine Science in the Coastal Zone	3	Wi
SMA 700	Master's Thesis Research	9	All
<b>ELECTIVES EXPECTED TO BE AVAILABLE</b>			
SMA 433/SIS 433	Envir. Degradation in Tropics	3	Wi
SMA 476	Intro. to Envir. Law & Process	3	Au
SMA 480/485	Marine Resources Cons. & Mgt./Pac. Recreation & Tourism	3	Wi
SMA 509	Integrated Coastal Management	3	Sp
SMA 510	Topics in Marine Ecology	3	Sp
SMA 511/514	Coastal Envir. Restoration & Mgt./Marine Polln. Mgt. & Policy	3	Au
SMA 512	Interviewing Methods & Envir. Topics	3	Sp
SMA 516/517	Seaport Mgt./Marine Uses: Transportation & Commerce	3	Wi
<b>Table 1 (Cont'd.)</b>			
SMA 525	Marine Protected Area Mgt.	3	Sp
SMA 550_	Current Events in Marine Affairs	1	Var?
SMA 555/ SISRE 555***	Comparative Marine Business in the North Pacific	3	Au

<sup>1</sup> Credits, course name, and quarter offered are as envisioned under new curriculum and may differ from current offerings. Courses listed SMA XXX/YYY are paired courses that typically would be offered in alternate years, usually by the same instructor. Courses with different prefixes are joint listings.

SMA 581	Fishery Mgt. Case Studies	3	Sp
SMA 585	Climate Impacts on the PNW	3	Wi

\*Offered by School of Law. \*\*Expected to be offered by SMA and School of Law on alternating basis. \*\*\*Offered at pleasure of SIS

The number of credits required for graduation remains the same (59). The introductory sequence adds 9 credits of new core requirements. New waiver policies will enable many students to reduce core course requirements by 3 credits over present levels. Beyond that, elective requirements are reduced to keep total requirements the same as the current curriculum (Table 2). The expected course distribution by quarter is shown in Table 3.

**Table 2. Expected Sources of Credits toward Graduation**

REQUIREMENT AREA	CREDITS
INTRODUCTORY SEQUENCE	12
OTHER REQUIRED CORE COURSES (Law, Policy Process, Marine Science, Quantitative Analysis, Policy Analysis, Economics)	18
ELECTIVES	16
THESIS SEMINAR	Var. (1/qtr., up to 3)
THESIS + PRESENTATION CREDITS/ADDITIONAL ELECTIVES IN LIEU OF THESIS	10
<b>TOTAL FOR GRADUATION</b>	<b>59</b>

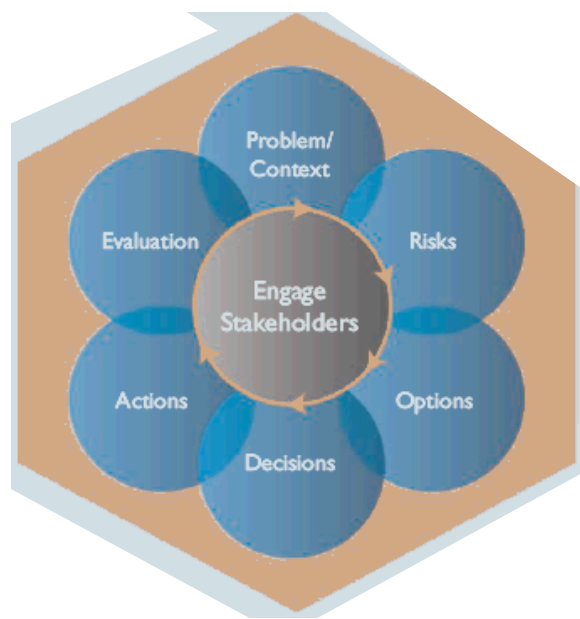
**Table 3. Typical Two-Year Progression through MMA Degree Requirements**

YEAR ONE					
Autumn	Cr.	Winter	Cr.	Spring	Cr.
500*	3	502*	3	503*	3
501*	3	537/538 (if elected)	3	507/508 (unless substituted)	3
536 (if needed)	3	591 (if needed)	3	515 (unless deferred)	3
506 (or elective if desired)	0-3	Elective if desired	0-3	519 (unless deferred or substituted)	3
Advising	1	Advising	1	Advising	1
<b>TOTAL CR.</b>	<b>10</b>		<b>10</b>		<b>13</b>
YEAR TWO					
506 (if desired)	3	537/538, 591 (if still needed or elected)	0-6	507/508, 515, 519 (if still needed or elected)	0-9
521/523 (in place of 507/508 or as elective)	3	Other electives	Var.	Other electives	Var.
Other electives	Var.			570	1
Thesis credits	Var.	Thesis credits	Var.	Thesis credits	Var.
<b>TOTAL CR.</b>	<b>10+</b>		<b>10+</b>		<b>10</b>
ELECTIVES TYPICALLY AVAILABLE					
476, 511/514, 555		433, 480/485, 516/517, 585		509, 510, 512, 525, 581	

## APPENDIX

### HUMAN DIMENSIONS OF GLOBAL CHANGE IN THE MARINE ENVIRONMENT: ILLUSTRATIONS AND DEFINITIONS

#### I. Conceptual Framing of Introductory Course Sequence: Life Cycle of a Policy Problem

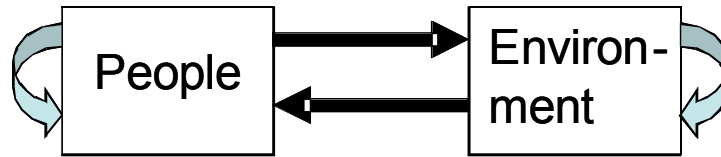


Source of Figure: Gilbert S. Omenn, AAAS Presidential Address, "Grand Challenges and Great Opportunities in Science, Technology and Public Policy", *Science* **314**: 1696 15 December 2006.

**Table A1. Primary Emphasis of Introductory Sequence Courses in Relation to Policy Life-Cycle Diagram**

Course	Problem/ Context	Risks	Options	Decisions	Action- Taking	Evalua- tion	Engage- ment
500 (IS #1)	X						X
501 (IS #2)	X	X					
502 (IS #3)		X	X	X			
503 (IS #4)				X	X	X	X

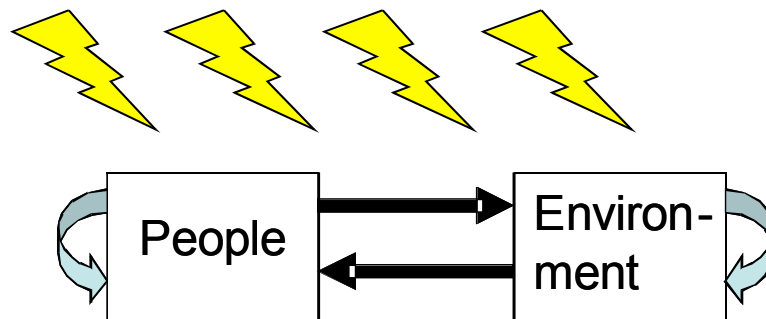
## II. Coupled Human – Environment Systems



“Some of the most challenging decisions in coastal management stem from the relationship between people and the environment. Coastal managers have become increasingly aware of the importance of using social science information and tools to address these relationships.”

Source: NOAA Coastal Services Center  
[http://www.csc.noaa.gov/cms/human\\_dimensions](http://www.csc.noaa.gov/cms/human_dimensions)

*Resilience in Coupled Human-Environment Systems and Links to Sustainability:*

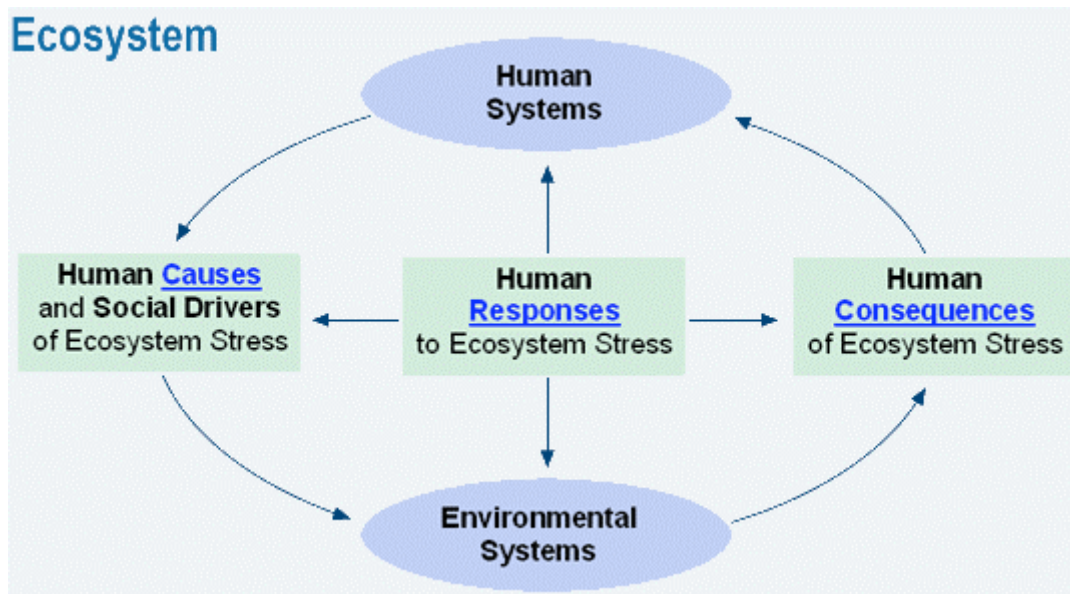


- The ability of either system to withstand or adapt to shocks to itself or to other systems to which it is linked
- The capacity of governance systems to accommodate change in ways that support societal development and environmental linkages for generations to come (Carl Folke)

### III. Human Dimensions

The human dimensions of ecosystems can be expressed in terms of three points of interaction between environmental and human systems:

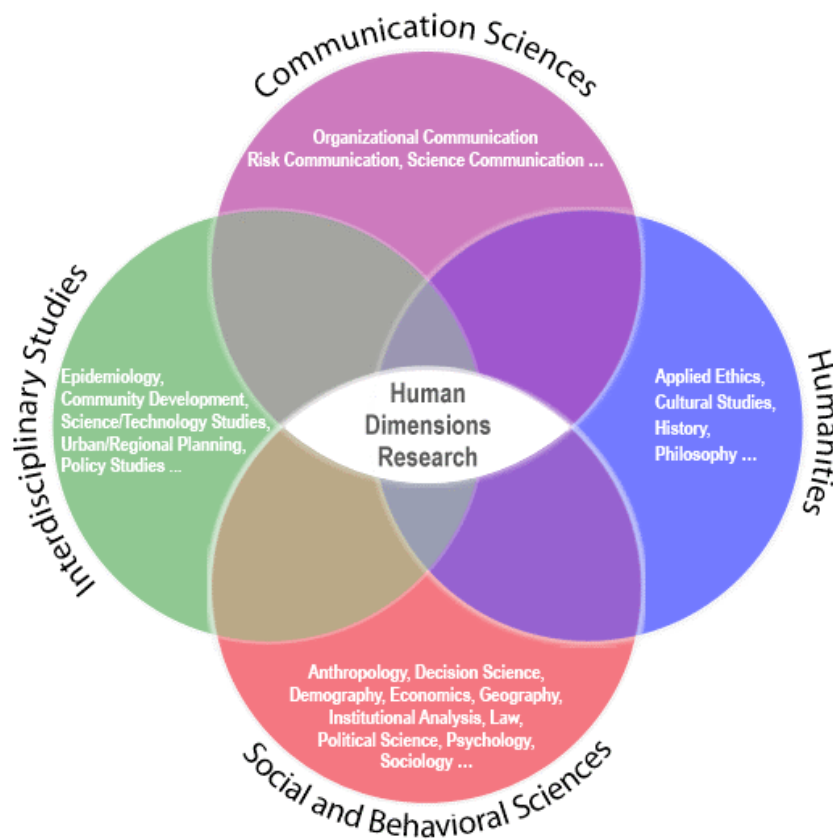
1. Human causes of ecosystem stress;
2. Human consequences of ecosystem stress; and
3. Human responses to ecosystem stress.



Source: NOAA National Centers for Coastal Ocean Science  
<http://coastalscience.noaa.gov/human/welcome.html>

## Human Dimensions Research

Human dimensions research aims to understand human–environmental interactions and facilitate use of this understanding to support decisions affecting environmental processes and their societal outcomes. Research on the human dimensions of ecosystems encompasses a broad array of interrelated disciplines across the social and behavioral sciences, humanities, communication sciences, and related interdisciplinary studies.



Source: NOAA National Centers for Coastal Ocean Science  
<http://coastalscience.noaa.gov/human/welcome.html>

#### IV. Global Change<sup>2</sup>

*Global change* is a far reaching concept. SMA means it to include *global climate change*, *cumulative effects* that manifest themselves at broad regional or global scales, and *globalization*, which engages both natural and social drivers of change—

- Change is *global* when its impacts are not and cannot be localized.
- Also referred to as *systemic change*, because regardless of where initiated, its effects diffuse across the whole planet.
  - Examples include many aspects of marine pollution
- *Cumulative change* is the accumulation of local changes that manifest themselves at broader (e.g., global) scales
  - The degradation of marine biodiversity—the result of myriad forces at work at many different temporal and spatial scales and simultaneously in many different locations—provides an example
- *Globalization*—although often associated narrowly with patterns of trade—can be thought of more generally as processes that occur simultaneously at multiple spatial and temporal scales.
  - More simply, the shrinking of spatial and temporal scales.
  - An example is growing seafood demand in affluent Western nations that leads to rapid conversion of mangroves in tropical developing nations to factory aquaculture production, perhaps at the expense of indigenous people who have depended on these same mangrove systems for their livelihoods for millennia.

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<sup>2</sup> After *Global Environmental Change: Understanding the Human Dimensions* (Washington, D.C.: National Academy of Sciences (1991) and