Appendix

List of Key Research Topics in Ecology

(Based on the discussion session for the invited speakers at the 3rd ISOME in Beijing Normal University, June 6, 2005)

1. Molecular and evolutionary ecology
   1) Genetic consequences of climatic and environmental changes
   2) Ecological adaptation and speciation – the effect of ecological factors on genotype and phenotype
   3) Ecological genomics
   4) Phylogeography – use DNA markers to study processes and patterns of geographical variation
   5) Relationship of genetic diversity to species diversity and community stability
   6) Life history evolution – functional groups, life-history trade-offs, implications to species coexistence, sex allocation
   7) Phenotypic plasticity

2. Ecophysiology
   8) Physiological adaptation and responses to extreme environments / in stressed environments
   9) Physiological responses and adaptation to global change
  10) Scaling of ecophysiological processes (including allometric scaling)
  11) Resource allocation, plant defense, and reproductive strategies (closely related to chemical ecology)

3. Population Ecology
   12) Population dynamics in heterogeneous environments (including metapopulation dynamics and metapopulation genetics)
   13) Role of dispersal in population dynamics and distribution
   14) Causes and mechanisms of population regulation
   15) Survival of small populations (demographic, genetic, and environmental stochasticities, as well as disasters)
   16) Population ecology of clonal organisms
   17) Interface between population and ecosystem ecology
4. Community Ecology
   18) Maintenance mechanisms of species diversity
   19) Neutral theory and species-area relationship
   20) Food web structure and trophic interactions
   21) Community phenological responses to environmental changes (in relation to global change, urbanization, etc.)
   22) Community organization and dynamics
   23) Species interactions
   24) Relationship between local and regional patterns/processes

5. Ecosystem Ecology
   25) Biodiversity and ecosystem functioning
   26) Ecosystem responses and feedbacks to global changes (e.g., climate change and land use change; emphasizing multiple stressors/factors)
   27) Ecosystem responses to local and regional-scale disturbances (including natural and anthropogenic disturbances, such as fires, grazing, nutrient enrichment, pest outbreaks, flooding, hydrological alterations)
   28) Ecological stoichiometry and elemental interactions

6. Landscape Ecology
   29) Relationship between spatial pattern and ecological processes (particularly population and ecosystem processes)
   30) Land use and land cover change and its ecological consequences (including urbanization, urban/wilderness interface, etc.)
   31) Disturbance and patch dynamics
   32) Landscape fragmentation and its effects on biodiversity and ecosystem functioning
   33) Scaling – transferring information across space, time, and organizational levels
   34) Ecosystem/landscape management
   35) Integration between ecology and landscape planning, design, and architecture
   36) Transdisciplinary studies of landscape sustainability

7. Global Change and Ecological Responses
   37) Global C, N, and hydrological cycles
   38) Human dimensions in global change (land use and land cover, decision/policy making, socioeconomic processes, human-induced disturbances, etc.)
   39) Field manipulative ecosystem experiments (soil warming, FACE, etc.)
   40) Multiple-scale monitoring/observing systems
   41) Thresholds, nonlinearity, and uncertainty in global change research

8. Biological Invasions
   42) Invasion mechanisms, processes, and prediction
   43) Methods, management, and policy for controlling and eradicating biological invasion
   44) Transcontinental exchange of species
   45) Impacts of biological invasion
9. Conservation Biology (Pattern, dynamics, mechanisms, and conservation of biodiversity)
   46) Spatial pattern, mechanisms, and conservation strategy of biodiversity
   47) Biodiversity and global change
   48) Impacts of major geological events on biodiversity
   49) Mechanisms and conservation strategies of threatened species
   50) Role of biodiversity in ecological restoration and rehabilitation
   51) Monitoring and information systems of biodiversity

10. Restoration ecology
    52) Assembly rules and restored ecosystem organization
    53) Spatial heterogeneity and restored ecosystem development
    54) Environmental stochasticity and ecological restoration design and evaluation
    55) Thresholds and nonlinearity in ecosystem degradation and restoration
    56) Development and study of reference ecosystems (along a gradient of disturbance for a specific ecosystem type)
    57) Whole-ecosystem experimental studies of ecological restoration

11. Ecosystem Services and Valuation
    58) Processes and underlying mechanisms that generate ecosystem services
    59) Quantification and identification of ecosystem services
    60) Spatial variability and dynamics of ecosystem services
    61) Relationship of ecosystem services to human activities and welfare
    62) Valuation methodologies and approaches

13. Other topics of special concern
    63) Methodology, field design, and statistical analysis of large-scale ecological experiments (some methodologies do exist, but their applications have rarely used or misused)
    64) Database networking and sharing
    65) Long-term ecological monitoring and research
    66) Outbreaks of epidemic and infectious species
    67) Impacts of grand engineering projects (hydroelectric dams, etc.) on biodiversity
    68) Ecological risk assessment
    69) Tree of life – Molecular phylogenetics