



Challenges and Opportunities in Remote Sensing of Global Savannas: A Scoping Study for a New TE Field Campaign

Niall Hanan (Colorado State U.) Michael Hill (University of North Dakota)







The geographic scope of woody-herbaceous systems



Figure 1. Global distribution of 'savannas' (mixed woodyherbaceous systems). For the purposes of this proposal (in which we seek to improve satellite remote sensing capabilities in woody-herbaceous systems) we include shrublands and savannas in both tropical and temperate regions. *Figure after Olson, 1994 and* Loveland et al., 1998.









































Global savannas: Australia:

i) sorghum woodland (Photo: Marks); ii) Aristida spp woodland, Larimah sandy site, NATT; iii) Triodia spp woodland, Larimah loam site, NATT; and iv) Dichanthium woodland, Larimah clay site, NATT (Photos: Hill).







Global savannas: South America:

i) cerrado (Photo: Bustamante); Colombian Ilanos – gallery forest (photo: Devia); iii) Colombian Ilanos – rolling savanna (Photo: Etter); and iv) Colombian Ilanos – grassland with sparse shrubs (Photo: Repizzo).







Santa Rita Experimental Range, Arizona







The geographic scope of woody-herbaceous systems



Figure 1. Global distribution of 'savannas' (mixed woodyherbaceous systems). For the purposes of this proposal (in which we seek to improve satellite remote sensing capabilities in woody-herbaceous systems) we include shrublands and savannas in both tropical and temperate regions. *Figure after Olson, 1994 and* Loveland et al., 1998.





NASA Science Priorities: relating to rates and causes of change in the Earth system, Earth system responses to climate and land use, and impacts of change on human civilizations.

Priority Science Themes in the savannas











Savanna Remote Sensing Workshop

March 2-4, 2010 University Club/Cherokee Park Ballroom, Lory Student Center Colorado State University, Fort Collins, Colorado

Participants by Continent

North America - 32

Europe - 7

South America - 4

Australia - 4

Africa - 3









Breakouts 2: Geographic Priorities and Opportunities



- 1. Africa
- 2. Australia
- 3. North America
- 4. South (and Central) America
 - 5. "Distributed"





SRS Workshop Outcomes

New developments and new opportunities since earlier TE field campaigns!!

> RS Science – vegetation structure, function & change

Savanna communities – land management, LCLUC, & livelihoods

Savanna ecology, function and change





New opportunities: RS retrieval of vegetation structure

MODIS VCF WOODY COVER

OPTICAL-RADAR SYNERGY







SRS Workshop Outcomes

New developments and new opportunities since earlier TE field campaigns!!

Savanna modeling – synthesis, DA, & prognosis

RS Science – vegetation structure, function & change

Savanna communities – land management, LCLUC, & livelihoods

Savanna ecology, function and change





Savanna modeling – synthesis, DA, & prognosis

Model structures and processes generally not appropriate

Heterogeneous woody-herbaceous canopy
Drought-prone and pulse-driven
Disturbance-prone (fire and herbivory)
Need to be more fully developed in
Land Surface Models
Carbon and nutrient cycle models
Dynamic vegetation models

An example: Model data assimilation of soil moisture





Savanna ecology, function and change







On-line evaluation: key science questions

Rate each prototype field program for addressing a key science

question(s). Distributed -USA -Highly effective Effective Partially effective Australiaess effective Not effective South America -Africa -15 0 5 10 20







On-line evaluation: new understanding

Distributed - USA - USA

Rate the potential of the prototype field programs to deliver new data, understanding and synthesis on savanna function.







On-line evaluation: technical feasibility



Rate the technical feasibility (i.e. measurements, flights, ability to derive relationships, build models, drive models, estimate fluxes or change etc etc) for the prototype field programs.







International Participation



- 1. Africa
- 2. Australia
- 3. Europe
- 4. South (and Central) America
 - 5. Distributed

Commentary

Savanna Scoping Study

Developing white paper for NASA TE

Submission due Fall 2010

Participation and inputs very welcome!!

http://www.nrel.colostate.edu/projects/srs/







SRS OBJECTIVES A: Improve passive and active RS of tree-grass systems

Associated Science Goals

 \succ ... carry out a field campaign (in one or several locations) to collect essential data for development, parameterization, and validation of remote sensing algorithms associated with tree-grass mixtures, savanna structure and function

 \succ ... use remote sensing for separate quantification of woody and herbaceous vegetation structure, phenology and function in savannas

 \succ ... examine synergy among different sensors (radar, lidar, broad-band, thermal and hyperspectral) and different spatial and temporal resolutions for quantification of savanna state, process, and change









SRS OBJECTIVES B: Stimulate "savanna model" development and testing

Associated Science Goals

Summer in the strength of t

 \succ ... provide required field data for model development, parameterization and data assimilation

 \succ ... stimulate exploration of the role of soil moisture in driving ecosystem function (carbon and water cycles, biogeochemistry) in heterogeneous, water-limited savanna ecosystems

 \succ ... stimulate exploration of the role of fire as a critical factor controlling vegetation structure, carbon storage and release of pyrogenic carbon and reactive gases





SRS OBJECTIVES C:

Apply new remote sensing and modeling techniques in savannas

Associated Science Goals

 \succ ... have algorithms and data processing systems in place for regular and routine extraction of savanna information (at landscape to global scales) using the suite of space-borne instruments currently operating and planned

Summer Stream savanna information to appropriate models (land surface models, biogeochemistry models, DGVM) to simulate and diagnose states and processes relevant to scientists and managers (e.g. vegetation structure, productivity, sustainability, carbon, water and nutrient dynamics)

 \succ ... facilitate long term monitoring (structure, function and response to anthropogenic and natural change) of savannas for improved management

 \succ ... make data and analyses freely and easily available to managers, scientists and the general public to enhance understanding and sustainable development of the savanna biomes



Richard Lucas, March 2010



Home » Environmental Science & Engineering » Ecology » Ecosystem Function in Savannas: Measurement and Modeling at Landscape to Global Scales

Ecosystem Function in Savannas: Measurement and Modeling at Landscape to Global Scales

Editor(s): Michael J. Hill, University of North Dakota, Grand Forks, USA; Niall P Hanan



Price: \$159.95 Cat. #: K10258 ISBN: 9781439804704 ISBN 10: 1439804702 Publication Date: October 15, 2010 Number of Pages: 430

Binding(s): Hardback

Email this title to a friend

Add to Cart

Related Titles

Neotropical Savannas and Seasonally Dry Forests: Plant Diversity, Biogeography, and Conservation Editor(s): R. Toby Pennington, Royal Botanic Garden, Edinburgh, Scotland; James A. Ratter, Royal Botanic Garden, Edinburgh, Scotland Publication Date: May 25, 2006 Price: \$119.95



