2013 STRATEGIC COLLABORATIVE SCIENCE PROGRAM SUMMIT

"2013 Science Summit"

Presentation by
I Sam Higuchi,* Staff Engineer
NASA-HQ Environmental Management Division
Office of Strategic Infrastructure

11 – 12 July 2013

(2nd Strategic Collaborative Science Program Summit)

NASA HQ; 300 E Street SW; Washington, DC
11 July 2013 – "PRC – 9H40 (9 floor, room H40)"
12 July 2013 – "MIC-3 - 3H46 (3rd floor, room H46)"

This presentation does not represent the official position of NASA or the United States government. This presentation reflects only the personal views of the presenter.

Express (Washington Post publicatin) 9 July 2013
http://www.expressnightout.com/printedition/PDF/EXPRESS_07092013.pdf

National Security Presidential Directive (NSPD) #40 – *"Access to Space"*

U.S. SPACE TRANSPORTATION POLICY

January 6, 2005

FACT SHEET

The President authorized a new national policy on December 21, 2004, that establishes national policy, guidelines, and implementation actions for United States space transportation programs and activities to ensure the Nation's ability to maintain access to and use space for U.S. national and homeland security, and civil, scientific, and commercial purposes. This policy supercedes Presidential Decision Directive/National Science and Technology Council-4, National Space Transportation Policy, dated August 5, 1994, in whole, and the following portions of Presidential Decision Directive/National Science and Technology Council-8/National Security Council-49, National Space Policy, dated September 14, 1996, that pertain to space transportation programs and activities: Civil Space Guideline 3b, Defense Space Sector Guideline c, Commercial Space Guideline 5, and Intersector Guideline 2.

National Security Presidential Directive #40

Responsibility for "Assures Access to Space":

1. ***Department of Defense***
2. ***National Aeronautics and Space Administration***

Sustainability – Resilience – Encroachment

IMPACTS OF CLIMATE CHANGE ON ACCESS TO SPACE

11th ASCE Aerospace Division International Conference (Earth and Space 2008)
Long Beach, CA, USA, March 3-6, 2008

U.S. SPACE TRANSPORTATION AND CLIMATE CHANGE:
POTENTIAL IMPACTS OF CLIMATE CHANGE ON ACCESS TO SPACE

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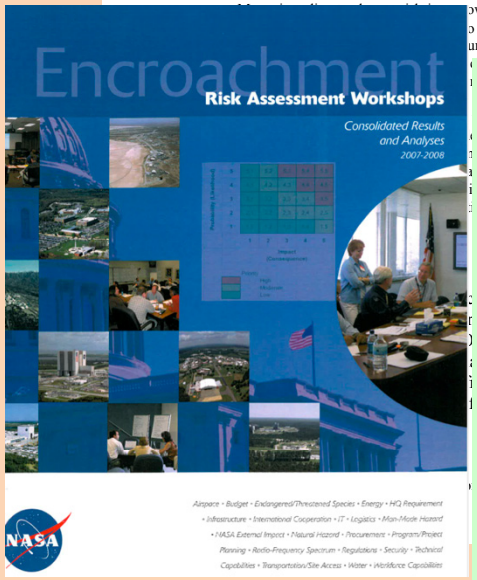
Abstract

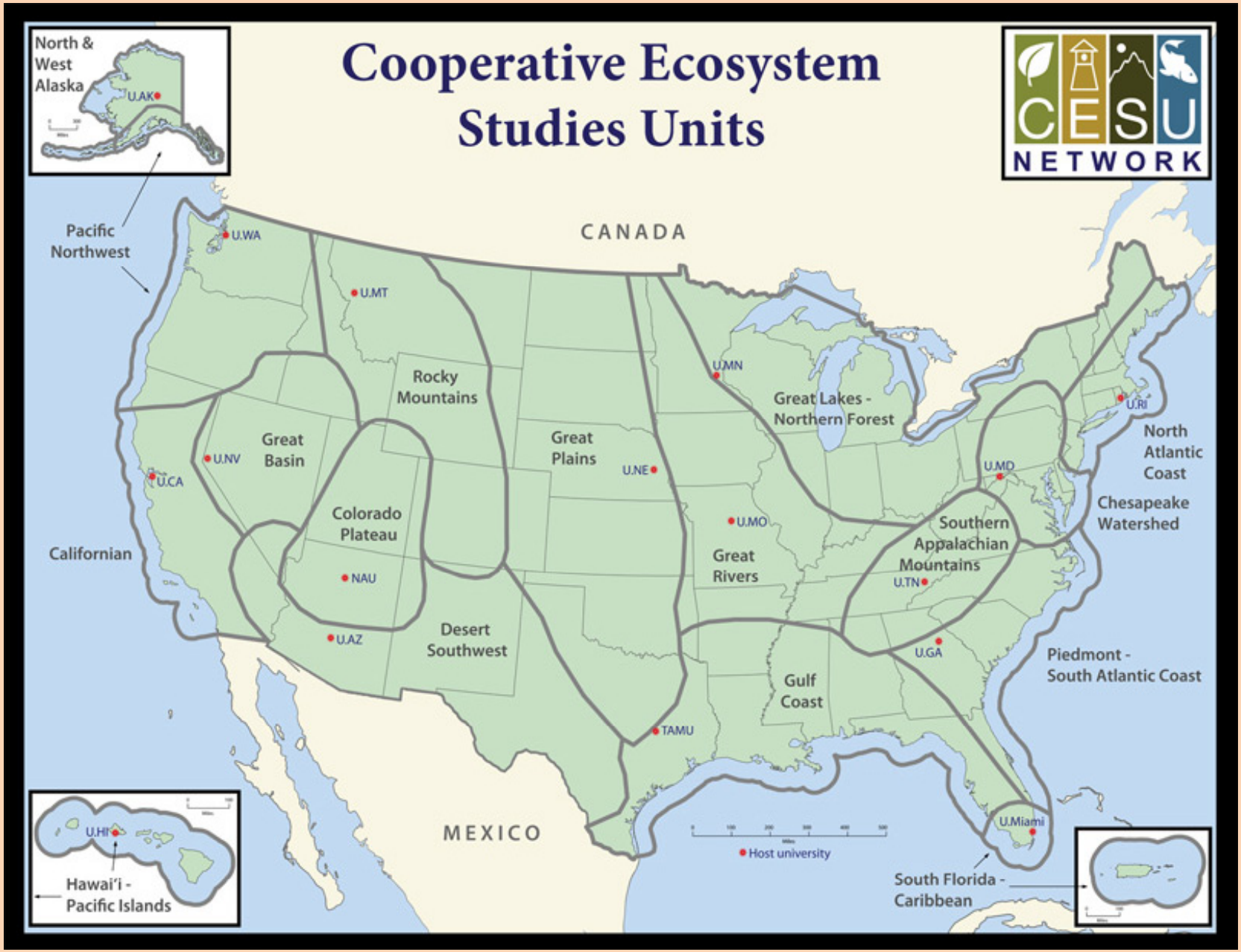
The President's Vision for Space Exploration - National Security Presidential Directive (NSPD) # 31 and U.S. Space Transportation Policy - NSPD # 40 both require continued access to Low Earth Orbit (LEO) over the long-term. However, there is a growing possibility that changing climate trends pose risks to our Nation's critical spaceport and LEO transportation capabilities.

owing field of study, but there are no known systematic approaches o date. Potential hazards to U.S. spaceports are generally recognized ure, sea level change, extreme weather events, and related natural



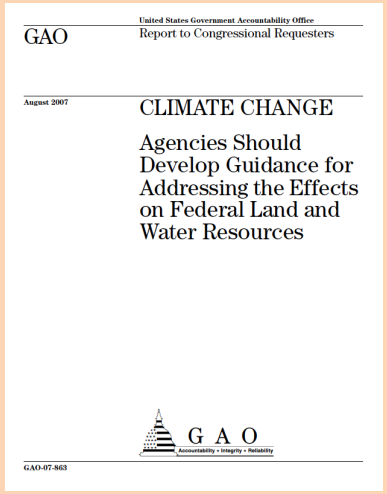
SOME ENCROACHMENT RISK CATEGORIES

- *Airspace*
- ***Endangered/ Threatened Species***
- ***Energy***
- ***Infrastructure***
- ***Natural Hazards***
- *Radio-Frequency Spectrum*
- *Transportation/ Site Access*
- ***Water***



http://www.cfc.umt.edu/cesu/Background.php

FEDERAL LAND & WATER RESOURCES


United States Government Accountability Office
GAO
Report to Congressional Requesters

August 2007

CLIMATE CHANGE

Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources

GAO

GAO-07-863

http://www.gao.gov/assets/270/265207.pdf

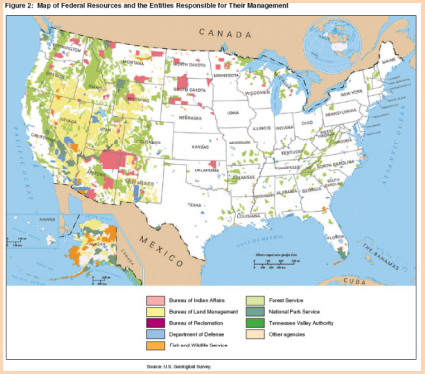


Figure 2: Map of Federal Resources and the Entities Responsible for Their Management

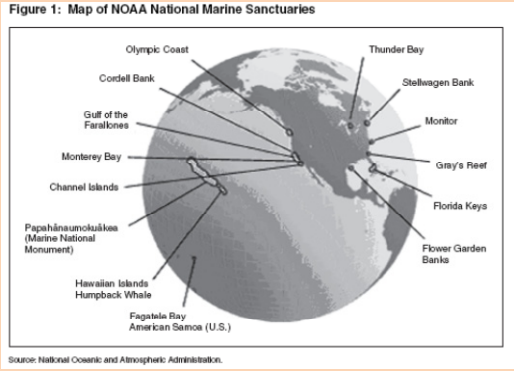


Figure 1: Map of NOAA National Marine Sanctuaries

Source: National Oceanic and Atmospheric Administration.

"The **Cooperative Ecosystem Study Unit (CESU)** is an existing tool that has not been fully utilized but:

CESUs could be utilized to conduct

- **regional-scale,**
- **cross-ownership boundary**

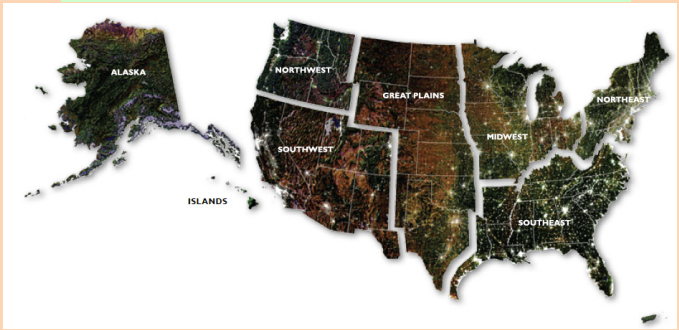
climate change effects." (page 118)

WHAT GAO FOUND *in 2007*:

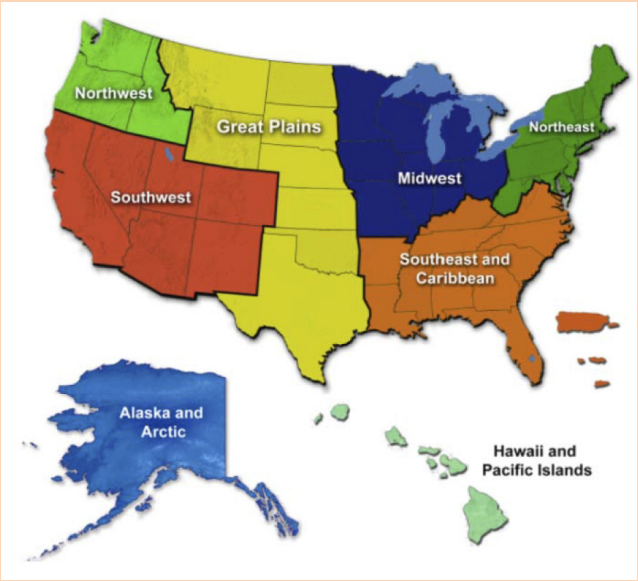
1) Managed natural resources are vulnerable to wide range of effects from climate change:
   - Physical effects
   - Biological effects
   - Economic and social effects
2) Resource managers are
   - Focused on near-term with less time for longer-term issues (e.g.; climate change)
3) Limited guidance on how to address climate change (DOI broad order January 2001)
4) **<u>Insufficient site specific information</u>** to plan for and manage effects and without such information:
   - Limited to reacting to effects and
   - Difficult to plan for future changes.

GAO (2007): *"Insufficient site specific information"*
Progress since 2007

2009 Global Climate Change Impacts in the US

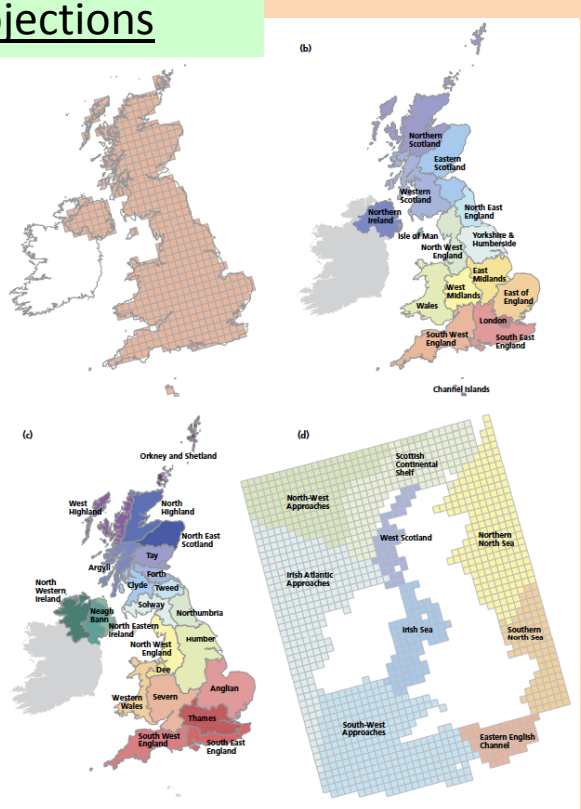


Draft 2012 National Climate Assessment



UK Projections

Variables over land areas
Mean temperature
Mean daily maximum temperature
Mean daily minimum temperature
99th percentile of daily maximum temperature in a season (*Warmest day of the season*)
1st percentile of daily maximum temperature in a season (*Coolest day of the season*)
99th percentile of the daily minimum temperature in a season (*Warmest night of the season*)
1st percentile of daily minimum temperature in a season (*Coldest day of the season*)
Precipitation rate
99th percentile of daily precipitation rate in the season (*Wettest day of the season*)
Specific humidity
Relative humidity
Total cloud
Net surface long wave flux
Net surface short wave flux
Total downward short wave flux
Mean sea level pressure
Variables over marine regions
Mean air temperature
Precipitation rate
Total cloud
Mean sea level pressure



UK Observations

http://ukclimateprojections.defra.gov.uk/media.jsp?mediaid=87868&filetype=pdf

UKCP09: Available data sets

These data sets are currently the best available. The Met Office reserves the right to issue periodic updates that reflect improvements in our ability to produce these grids. This section outlines which data sets are currently available on daily, monthly and annual timescales, at 5 x 5 km resolution, as well as long-term averages at 5 x 5 km and 25 x 25 km resolutions and as regional values.

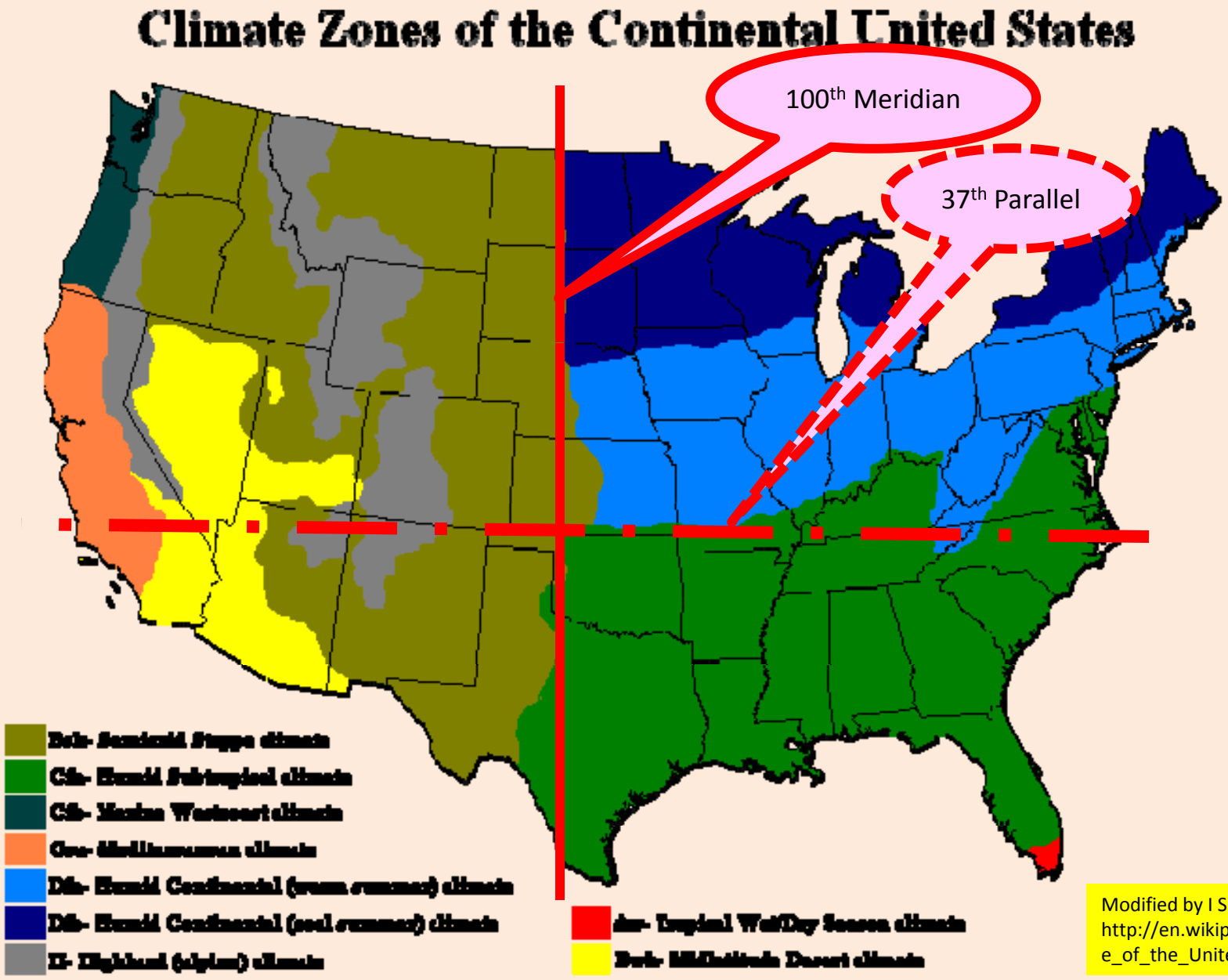
Please view the summary (PDF, 12 kB) of available data sets. Alternatively, follow the links below for detailed information.

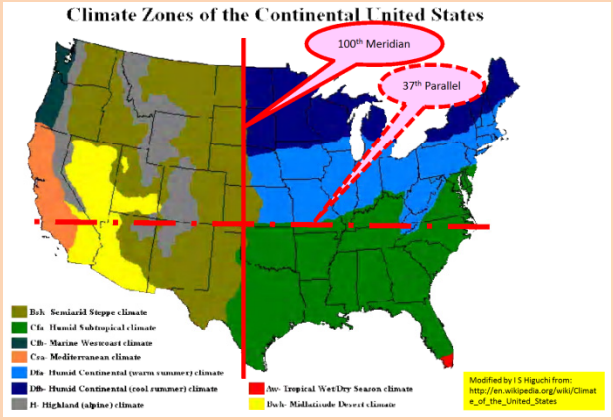
- **Daily data sets**
- **Monthly data sets**
- **Annual data sets**
- **Average data sets**

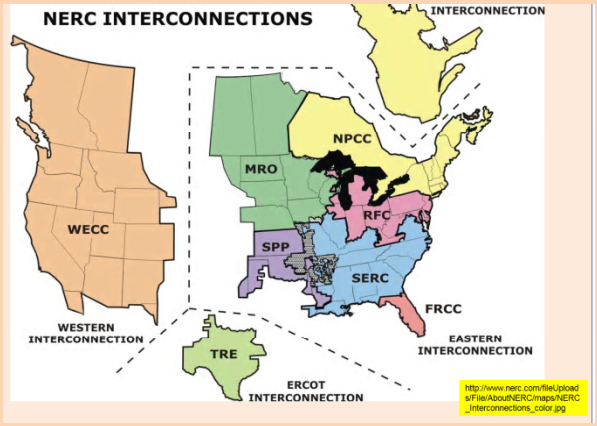
http://www.metoffice.gov.uk/climatechange/science/monitoring/ukcp09/available/index.html

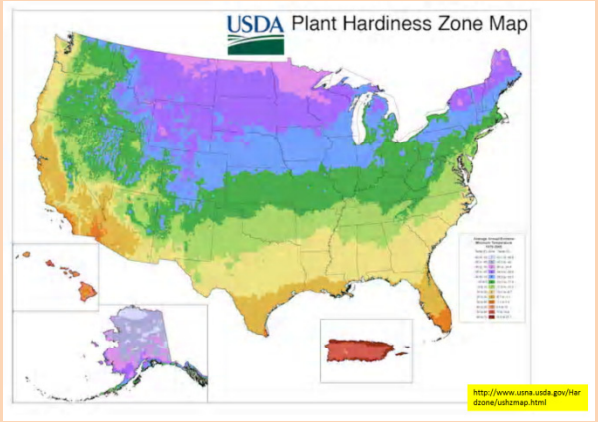
Rules of Thumb: Dividing the Country into 4 major natural systems based on:

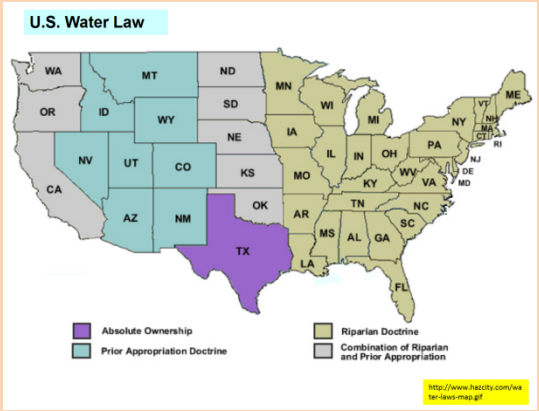
- 100th Meridian - Water (precipitation) 20 inches per year: Arid and Humid
- 37th Parallel - Growing season (temperature) 200 days per year: Long and Short

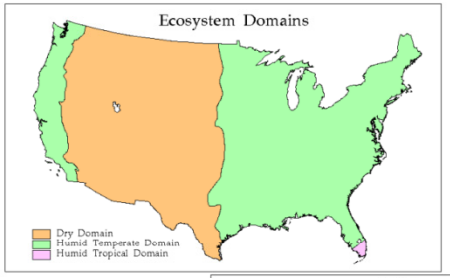








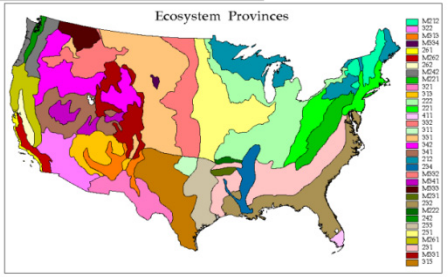




Eco-Regions of the United States

USDA – Forest Service

R G Bailey http://www.fs.fed.us/land/ecosysmgmt/index.html

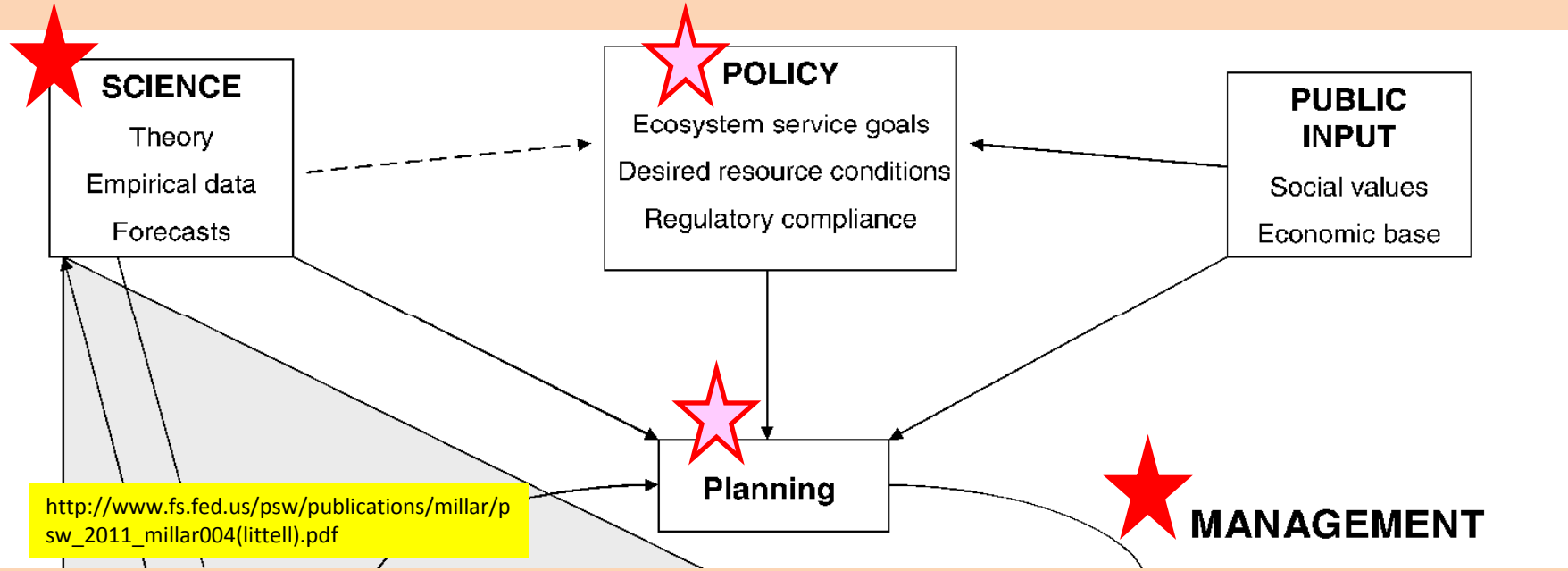


http://www.fs.fed.us/land/ecosysmgmt/colorimagemap/ecoreg1_domains.html

NEEDS

Science: *Monitor and Re-Assess*

Science and Management: *Resource Protection Levels*



TIME SNAP-SHOTS

1) Past
2) Present
3) Near Future
4) Distant Future

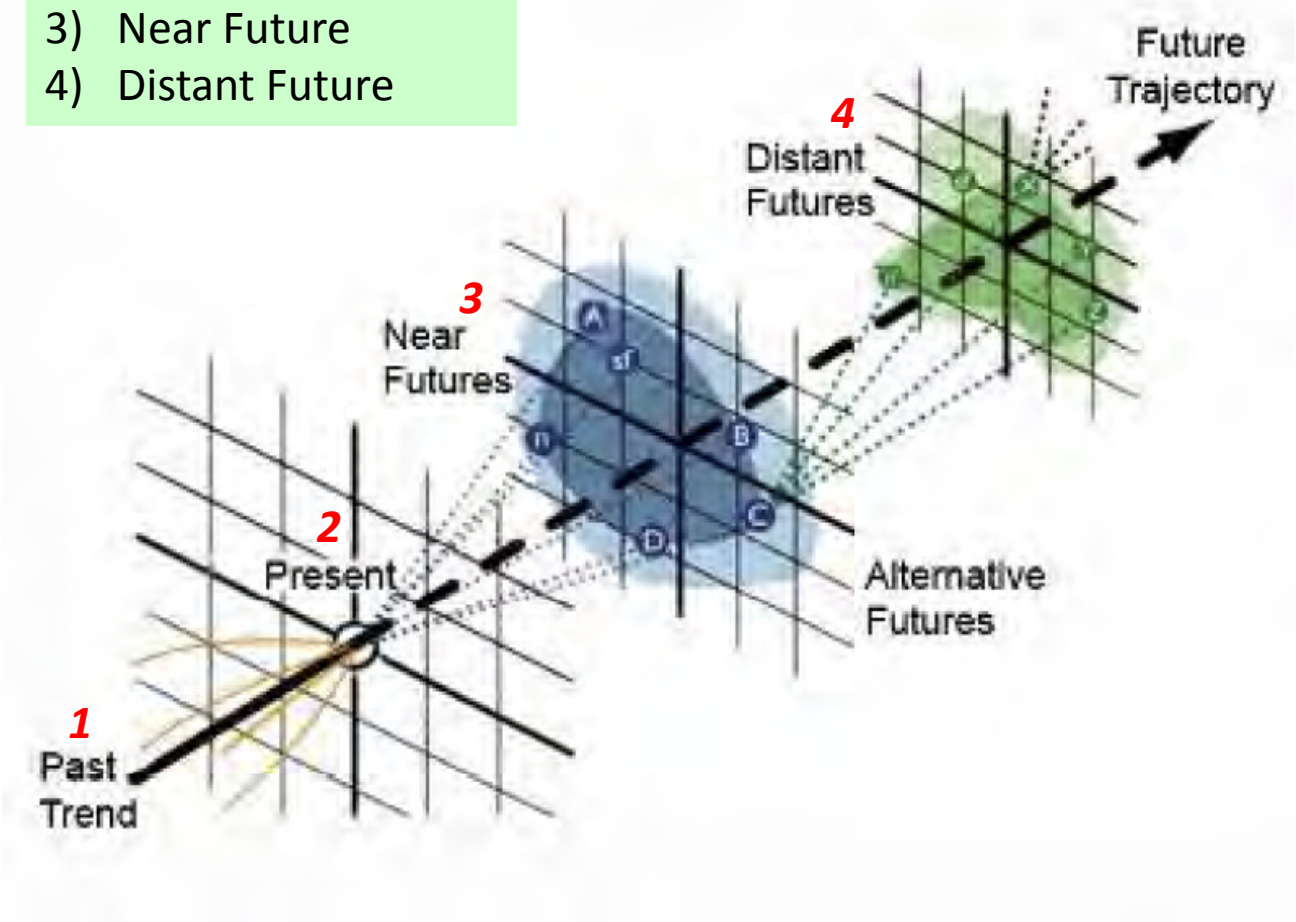
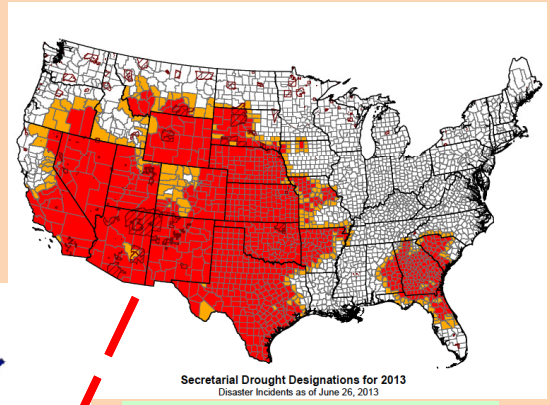


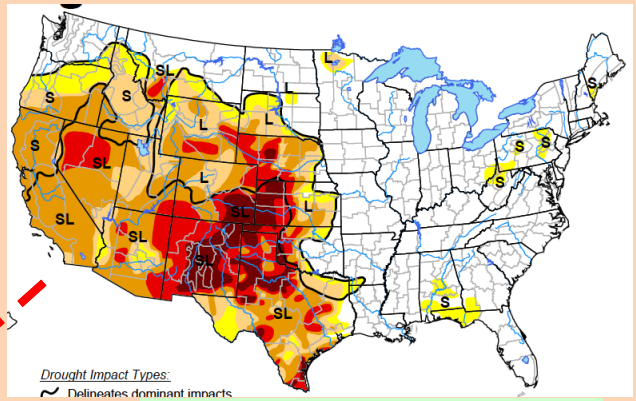
FIGURE 7.1 LANDSCAPE FUTURES CONCEPTUAL MODEL OF TRENDS, SCENARIOS AND FUTURE TRAJECTORY (ADAPTED AFTER SHEARER 2005)

http://www.nccarf.edu.au/sites/default/files/attached_files_publications/FinalReport(WebRes)-Morley-PastPresentFutureLandscapes.pdf

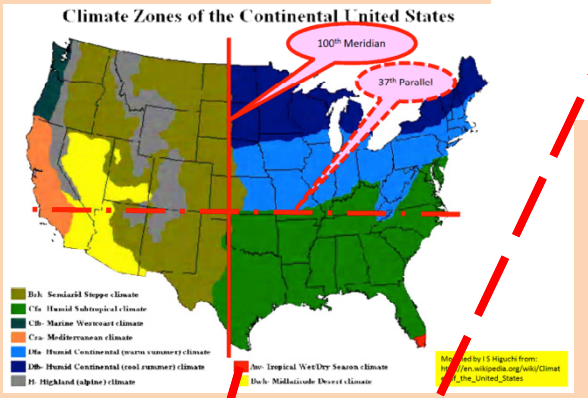
Water Resources & Drought

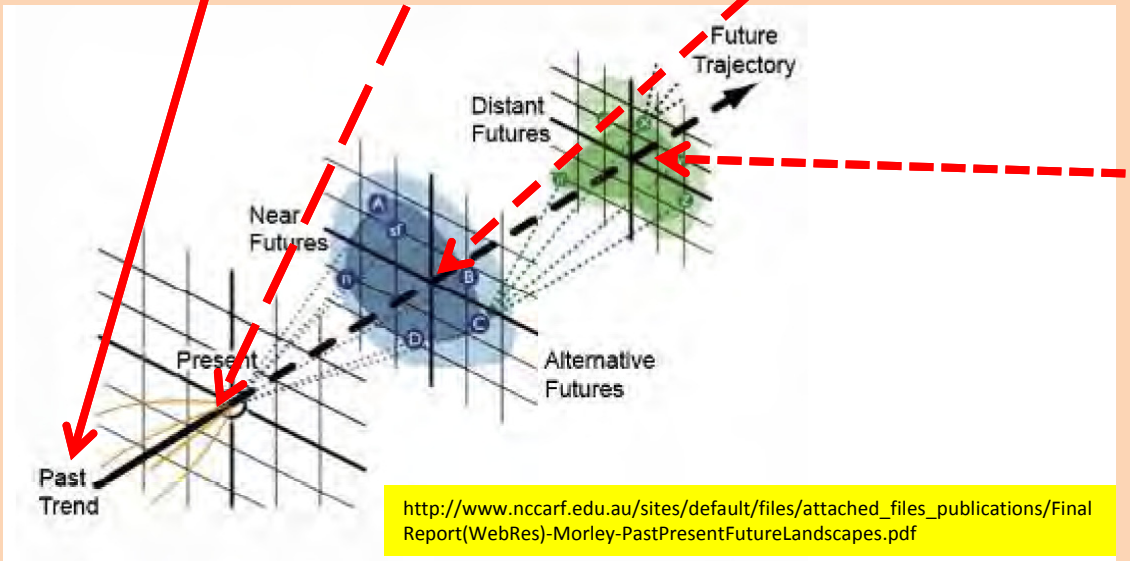


2013 Designations



2013 Drought Monitor





http://www.nccarf.edu.au/sites/default/files/attached_files_publications/FinalReport(WebRes)-Morley-PastPresentFutureLandscapes.pdf

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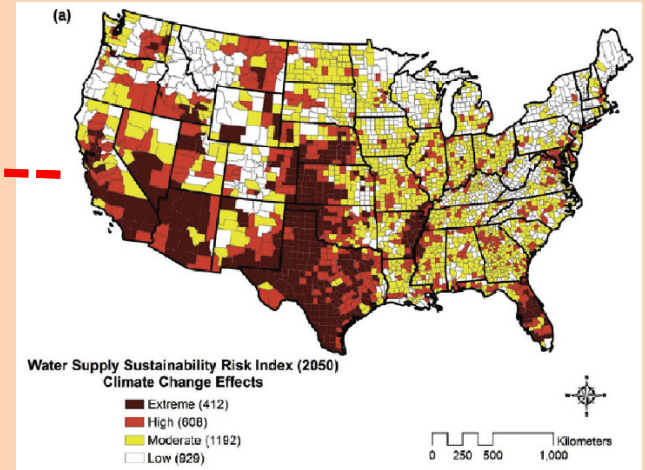


2050 NCA Water Supply Risk

Dr. Jim Westervelt

Construction Engineering Research Lab

Engineer Research and Development Center

Army Corps

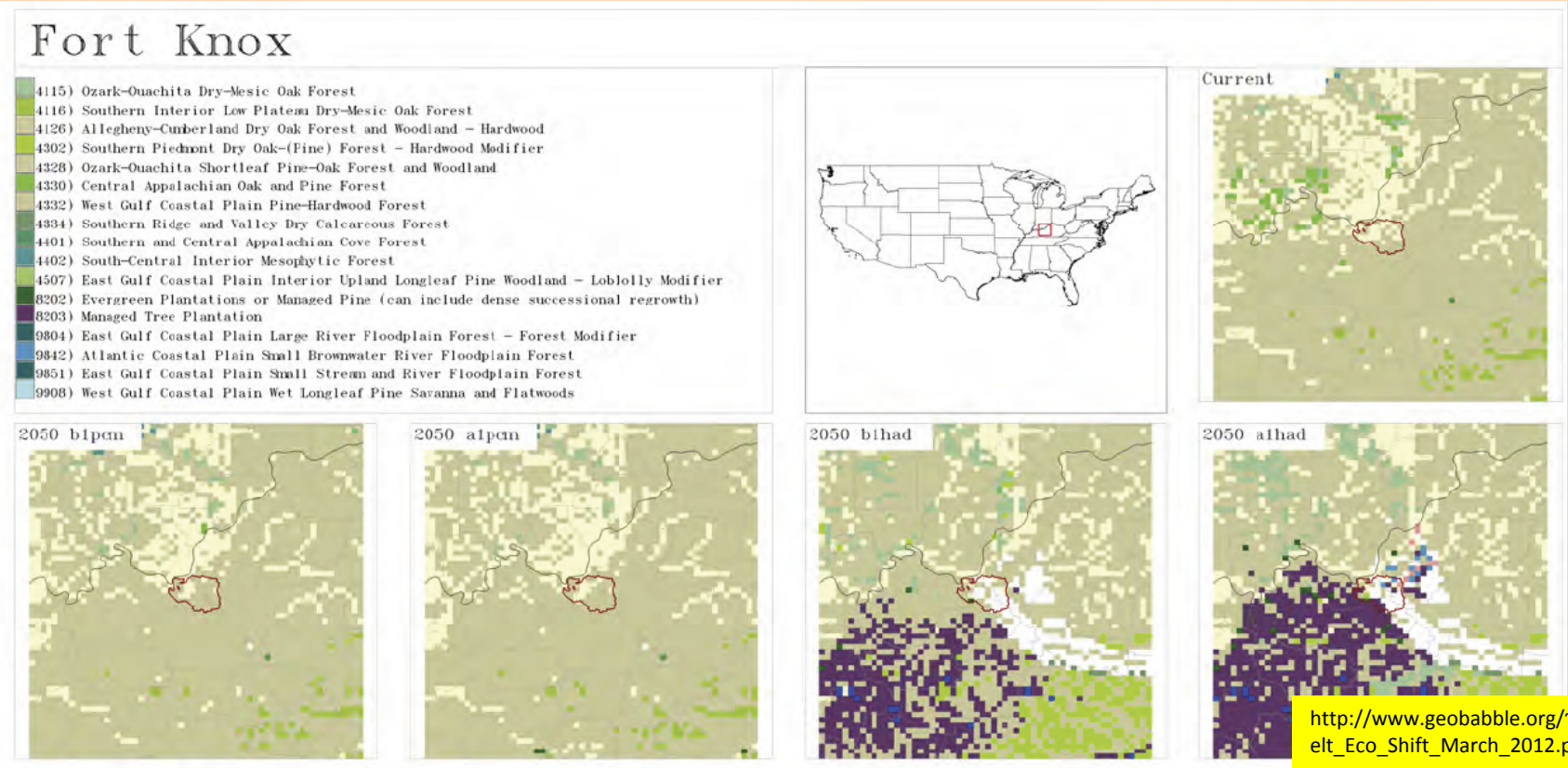
Dr. William Hargrove

Eastern Forest Environmental Threat Assessment Center

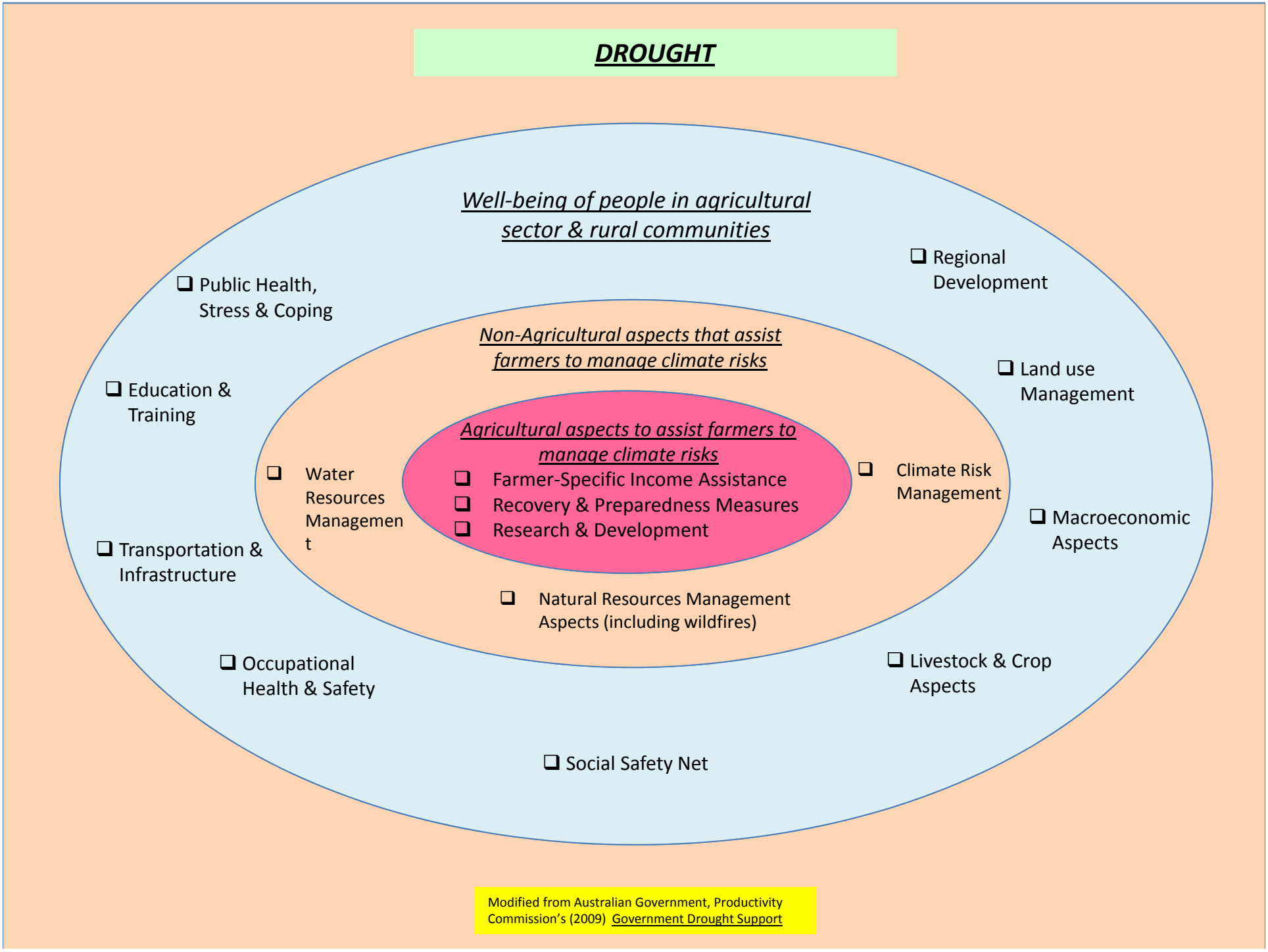
Forest Service

Results for Military Installations

- All Navy, Marines, Air Force, and Army
- Two Models
  - ►Hadley and PCM
- Two Scenarios
  - ►A1 and B1
- Three time periods
  - ►2000, 2050, and 2080



http://www.geobabble.org/~hnw/Westervelt_Eco_Shift_March_2012.pdf



Modified from Australian Government, Productivity Commission's (2009) Government Drought Support

USDA

Climate Change & Agriculture in the US

Social-Ecological System

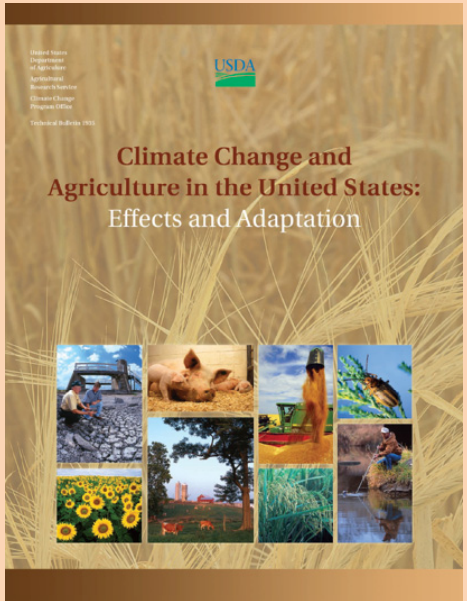


Fig. 2.14. A schematic framework representing key linkages between the anthropogenic drivers of climate change and the global climate system (IPCC 2007, p 26, Figure I.1). An assessment of the interactions between key components of this system may inform the development of adaptation options to reduce future climate change impacts on the United States agricultural SES.

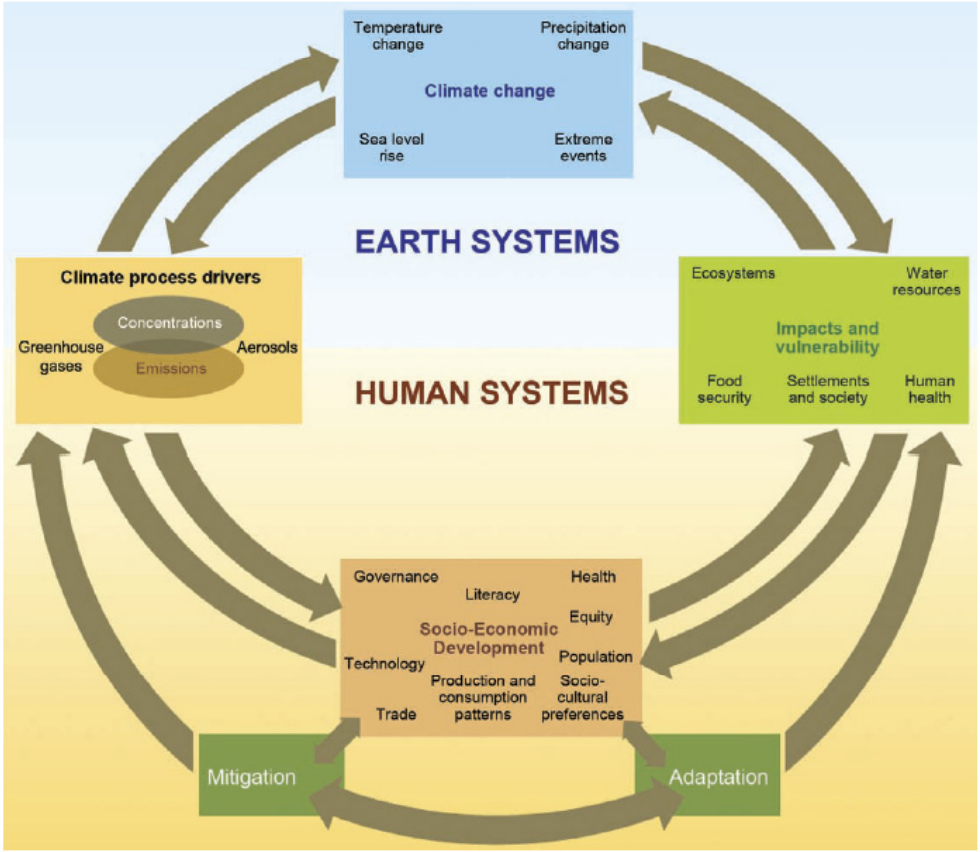
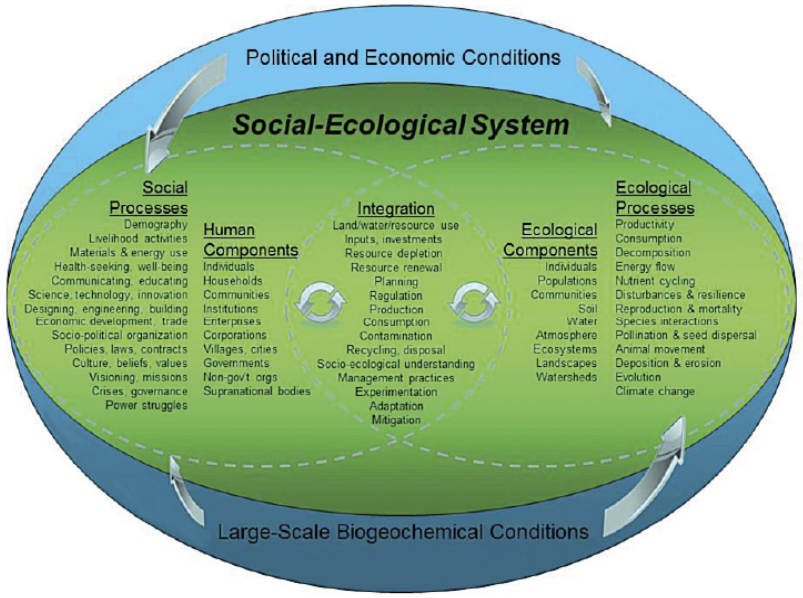


Fig. 2.13. The United States agricultural social-ecological system can be viewed as a dynamic system of interacting social and ecological components and processes linked to global scale biophysical systems such as climate system and the nitrogen cycle and global scale social systems such as international trade and governance (Humphrey 2011).



http://www.usda.gov/oce/climate_change/effects_2012/CC%20and%20Agriculture%20Report%20(02-04-2013)b.pdf

NASA and
"Priority Water Resource Caution Area"

St. Johns River Water Management District 2008

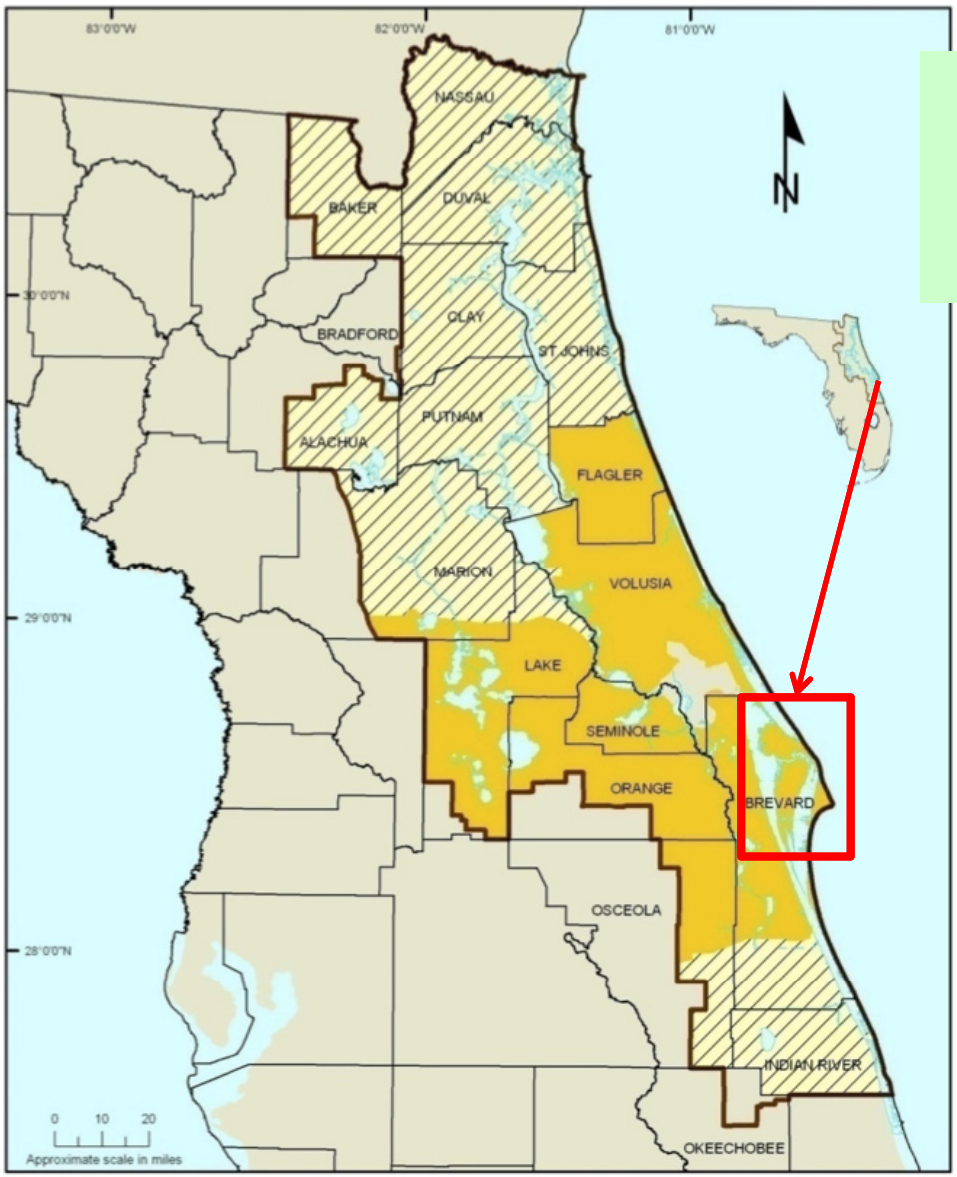


Figure 14. Priority water resource caution areas and potential priority water resource caution areas in the St. Johns River Water Management District, 2008

CURRENT SITUATION

Operation and Mission

Kourou

K. Barthelemy (2007) "Chaque geste compte", Latitudes 5

Cape Canaveral

KSC-2009-2754 (04/18/2009)
http://mediaarchive.ksc.nasa.gov/search.cfm?cat=23

Sea Turtles

Kourou

Environnement

Pouponnière de tortues

Geneviève Gasal marque une tortue olivâtre

Dans le cadre du volet scientifique du projet CARET (cf encadré), quatre organismes se répartissent le suivi des tortues marines : coordinateur général, le WWF surveille les plages de l'ouest (Awala-Yalimapo, Pointe Isère...). Kwata s'occupe de Cayenne/Rémire-Montjoly et la Sepanguy gère les plages de Kourou. Enfin, le CNRS est chargé du suivi des olivâtres par balises Argos. Constatant ces dernières années une diminution des pontes sur les plages de Kourou ville au profit des dix kilomètres de Kourou Ouest, Geneviève Gasal, coordinatrice du suivi des tortues marines à la Sepanguy, et son équipe, décident d'y faire un suivi plus soutenu. En effet, entre bois flottés et vase

ELSEVIER

Journal of EXPERIMENTAL MARINE BIOLOGY AND ECOLOGY

The world's largest leatherback rookeries: A review of conservation-oriented research in French Guiana/Suriname and Gabon

Sabrina Fossette[a], Laurent Kelle[b], Marc Girondot[c,d], Edo Goverse[e], Maartje L. Hilterman[f], Bas Verhage[g], Benoît de Thoisy[h], Jean-Yves Georges[a,*]

Photograph from K. Barthelemy (2007) "Chaque geste compte", Latitudes 5 ; also see article K. Barthelemy (2006) "Pouponnière de tortues« , Latitudes 5.

Cape Canaveral

Loggerhead sea turtle *(Caretta caretta)*
Green sea turtle *(Chelonia mydas)*
Leatherback sea turtle *(Dermochelys coriacea)*

Global Change Biology (2004) 10, 1–4 doi: 10.1111/j.1365-2486.2004.00817.x

Earlier nesting by loggerhead sea turtles following sea surface warming

JOHN F. WEISHAMPEL, DEAN A. BAGLEY and LLEWELLYN M. EHRHART
Department of Biology, 4000 Central Florida Boulevard, University of Central Florida, Orlando, FL 32816-2368, USA

Abstract

The onset of spring, noted by the timing of wildlife migratory and breeding behaviors, has been occurring earlier over the past few decades. Here, we examine 15 years of loggerhead sea turtle, *Caretta caretta*, nesting patterns along a 40.5 km beach on Florida's Atlantic coast. This small section of beach is considered to be the most important nesting area for this threatened species in the western hemisphere. From 1989 to 2003, the annual number of nests fluctuated between 13 000 and 25 000 without a conspicuous trend; however, based on a regression analysis, the median nesting date became earlier by roughly 10 days. The Julian day of median nesting was significantly correlated with near-shore, May sea surface temperatures that warmed an average of 0.8°C over this

Wildlife - birds

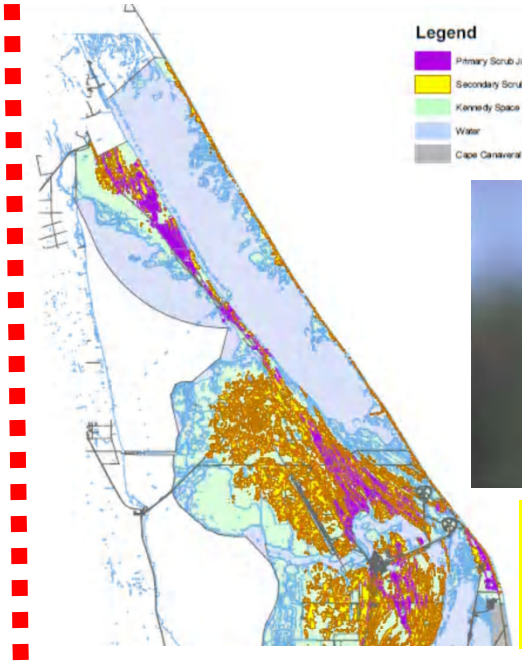
Kourou

White-winged Swallow *(Tachycineta albiventer)*

Par K. Barthelemy & S. Druet-Lamy (2006 (October)) “Vivre en Guyana”, Latitude 5

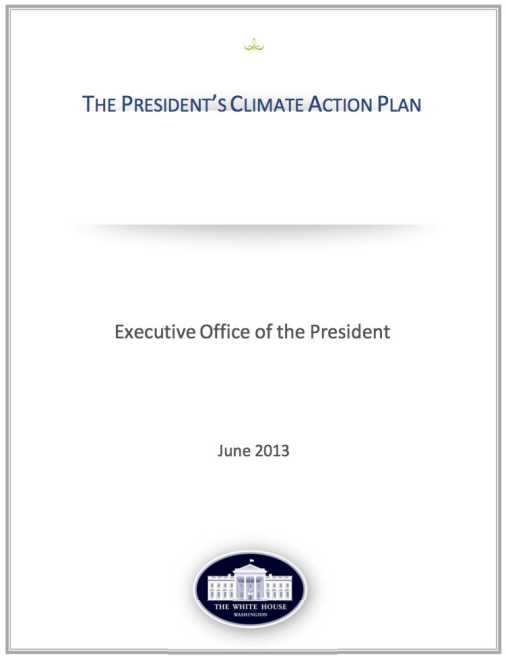
Cape Canaveral

Florida Scrub Jay *(Aphelocoma coerulescens coerulescens)*



Florida Scrub Jay habitat map from “Cape Canaveral Spaceport Master Plan” (2002)

http://www.blm.gov/es/st/en/fo/Jackson_Home_Page/jupiter_ONA/jupiter_ona_photos/jupiter_photos_wildlife.html



http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf

- Building Stronger & Safer Communities and Infrastructure
- **Protecting the Nation's Economy and Natural Resources**
- **Using Sound Science to Manage Climate Impacts**

- ***Working with Other Countries to Take Action to Address Climate Change***

Learning from Others --
INTERNATIONAL ASPECTS OF "BEST MANAGEMENT PRACTICES"

BEST MANAGEMENT PRACTICES FOR	EXPERTIES OR EXPERIENCE WHERE	REMARKS
1) Local Adaptation Programs	UK	5-km or 12-km resolution data available to local governments
2) Infrastructure Design & Planning	Canada	Literature Review and Training Engineers
3) Coastal Flooding	Australia	Government documents available to local governments for planning
4) Storm Water and Infrastructure Planning	New Zealand	Screening, IDF Curves
5) Drought Response	Australia	Government documents available to local governments
6) Catastrophic Asset Management	Europe	Association of British Insurers, MunichRe, SwissRe,
7) Moving beyond the Mean to Extremes	Australia	R N Jones

THE RIGHT PEOPLE ARE IN THE ROOM!!

It is OK to be prepared for life as it is today;

But it is awesome to be prepared for making life better for today and the future.

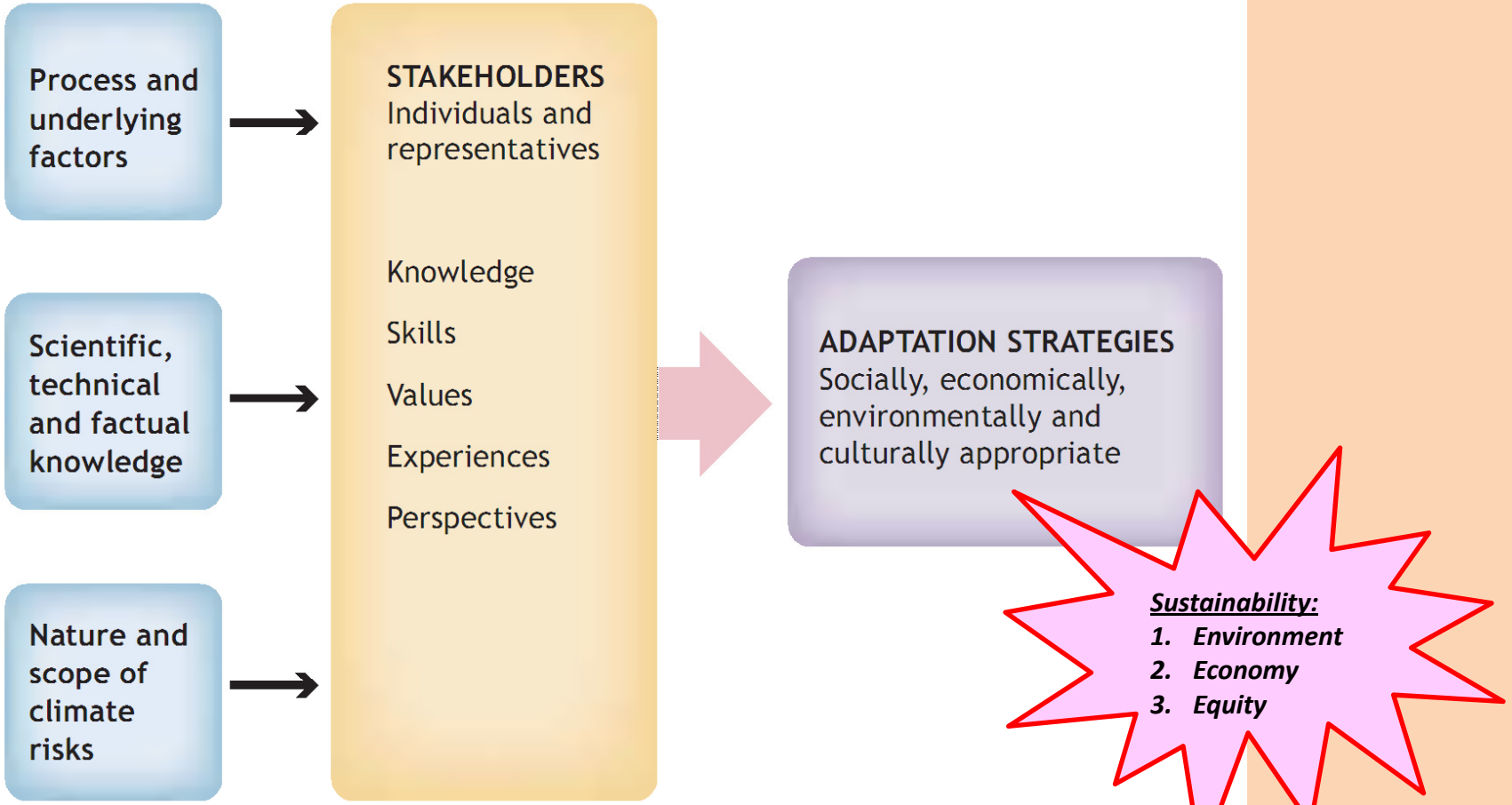


Figure 3: Roles and responsibilities of stakeholders in the adaptation process.

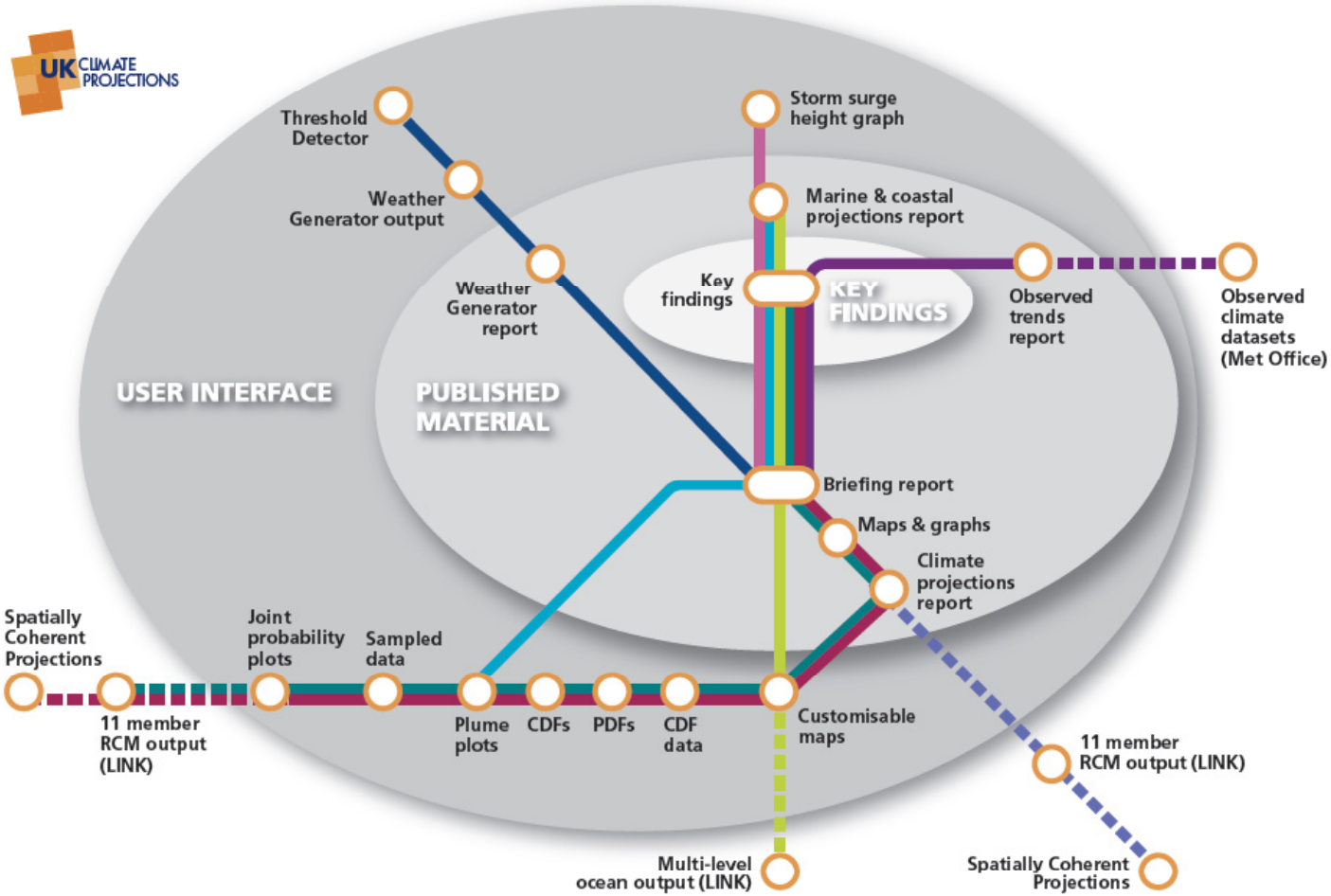
UKCIP (xxxx) Identifying Adaptation Options http://www.ukcip.org.uk/images/stories/Tools_pdfs/ID_Adapt_options.pdf

Unlike the 'Lone Ranger' --

This is not a "Tom & Sam" meeting!

Photo Credit: Disney Enterprises Inc.
http://www.readexpress.com/2013/07/stable-heroes/


STOP



http://ukclimateprojections.defra.gov.uk/media.jsp?mediaid=87823&filetype=pdf

http://ukclimateprojections.defra.gov.uk

Learning from Others --

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BEST MANAGEMENT PRACTICES FOR	EXPERTIES OR EXPERIENCE WHERE	REMARKS
1) Local Adaptation Programs	UK	5-km or 12-km resolution data available to local governments
2) Infrastructure Design & Planning	Canada	Literature Review and Training Engineers
3) Coastal Flooding	Australia	Government documents available to local governments for planning
4) Storm Water and Infrastructure Planning	New Zealand	Screening, IDF Curves
5) Drought Response	Australia	Government documents available to local governments
6) Catastrophic Asset Management	Europe	Association of British Insurers, MunichRe, SwissRe,
7) Moving beyond the Mean to Extremes	Australia	R N Jones