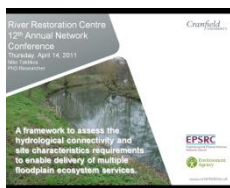


Presentation 2 – Taktikos, Niko



In a nutshell.....

Framework on how to deliver multiple ecosystem services on a floodplain

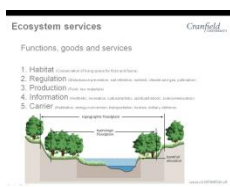
How to select a suitable site

How to manage the water regime of the site



Floodplains are distinctive landscapes - environmental resources and many natural attributes = multiple ecosystem services

1966, origin of the ecosystem services concept.



MA – No. of ways to categorize ecosystem services e.g. organizational, descriptive and functional.

For the purpose of this research, ecosystem services shall be categorized in functional groupings based on MA, 2003, de Groot, 2002 and de Groot et al, 2006.

MA – Supporting, Provisioning, Regulating and Cultural

Classification of ecosystem functions. Goods and services based on Rudolf S. de Groot

1. Functions explained:

Regulation (Maintenance of essential ecological processes and life support systems)

Habitat (suitable living space for wild plant and animal species)

Production (Provision of natural resources)

Information (Provide opportunities for cognitive development)

Carrier (Providing a suitable substrate/medium for human activities and infrastructure)

1. Ecosystems are a finite resource (MA)



Living beyond are means

Value of ecosystems largely underestimated

Human activity = strain on nature and earth's capacity to support current and future generations.

2. Single function land use dominant

E.g. Agriculture, FSA's, SSSI's

Pressure to meet human needs based drivers – local landowners or county/regional and national influence (stakeholders)

Tradeoff's

Benefits of one service may affect the supply of others

Provision of one service reduces and/or limits the capacity to provide other range of services

e.g. Agriculture – land use change (one services dominant)

3. Vulnerability

Ecosystem: Land use change physical modification of rivers (land drainage, embankment) loss and removal of habitat and species (species removal)

Social and Economic vulnerability: Floods and land use tradeoff's

Natural disasters (flooding), anthropogenic disasters (pollution), affect on chemical processes (Nitrogen, carbon) underlines ecosystem services health and render land habitable.

4. Protect and improve natural resource: Ecosystem are a finite resource

Healthy ecosystem = Provision of food, fresh water, energy and materials, protection from disease and disaster – allow us to make choices about our way of life

Security: Personal safety, secure resources access, security from disasters

Basic materials for a good life: adequate livelihoods, sufficient nutritious food, shelter, access to goods

Health: strength, feeling well, access to clean air and water

Good social relations: social cohesion, mutual respect, ability to help others

Freedom of choice and action: opportunity to be able to achieve what an individual values doing and being.

5. European and national policies and legislation drivers

DEFRA "Making Space for Water"

DEFRA "Delivering a healthy natural environment" – ECOSYSTEMS APPROACH ACTION PLAN

EU Directives

Water Framework Directive

Floods Directive

England and Wales regulations

Conservation of Habitats and Species

Flood and Water Management Act

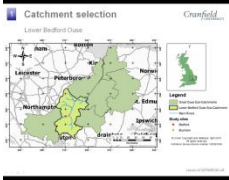
Pitt Review 2007

Foresight Future Flooding Report

Millennium Ecosystem Assessment

5. Multifunctional land use: benefit to multiple stakeholders and synergy between ecosystem services

Upper Great Ouse Catchment, East of England, U.K



Why did you pick this Sub-catchment ?

- Second largest Sub-Catchment of RGO at 1569km², Eastern Rivers 1661km²
- Incorporates RGO and 4 of its main tributaries River Ivel, River Kym, Alconbury Brook
- Major Urban Area – Bedford
- Variable topography 30-10mAOD over 50km
- Geology – Limestone (S) and mudstone (N)
- Soils-Low permeability clay
- Predominantly Agricultural land use
- Annual Rainfall: 700-500mm (wide range)
- Large influence of main tributaries to RGO – hydrograph flood peak increase between Bedford and St. Neots
- Administrative Boundary Logistics – Geographical proximate to Cranfield University and Environment Agency, Anglian Region, Central Area Office
- Ecosystem services strategic opportunities e.g.

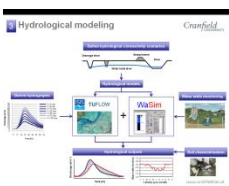
- Regulation (flood alleviation)
- Information (recreation) – parks water sports fishing
- Habitat (nursery and refuge – protect and enhance habitat for terrestrial and aquatic species).
- River Great Ouse Catchment Flood Management Plan and interviews with EA FRB, FRM



1. Pick 3 contrasting case study sites for variability between site characteristics
2. Site selection based on the following:

- Strategic site opportunities e.g. Current projects – Environment Agency, Charity groups – Desktop studies/literature review and stakeholder interviews
- Lateral connectivity – National Flood and Coastal Defence Database – Asset Type: Raised Defences e.g. embankments
- Site characteristics
- Upstream Catchment Area (Area of influence)
- River discharge (Geometrics and flow)
- Floodplain geometry (Area of influence)
- Soil type (drainage indicator)
- Lateral connectivity (embankments on one or both sides of river, crest level, SOP)
- Vertical connectivity (drainage network – surface ditch, sub surface drains e.g. pipes)

	Bedford	Blunham
Geographic location	TL08414 50313	TL15588 51535
Upstream Catchment Area (km ²)	1469.78	539.66
Floodplain study Area (ha)	200	105
QMED (m ³ /s)	80.7	19.8
Soil Type	Silty clay loam	Clay loam



1. Define hydrological connectivity scenarios
- Four scenarios to encompass a range of lateral and vertical connectivity options
- Scenario 1: Existing floodbank and existing drainage
 - Scenario 2: Existing floodbank and modified increase/decrease in drainage*

Scenario 3: Removal of floodbank and existing drainage

Scenario 4: Removal of floodbank and modified increase/decrease in drainage*

2. Use Hydrological models

a. Inundation modeling – lateral connectivity

Halcrow – ISIS 1 and 2D

WBM TUFLOW 2D

i. Derive Hydrographs = input to inundation model

1 in 2 to 1 in 100 year = Frequent (natural floodplain functioning) to extreme events

Seasonality (Winter and Summer)

Methods:

(Flood frequency Analysis)

FEH Statistical method

FEH revitalized FSR/FEH rainfall runoff method

b. Water table modeling – vertical connectivity

Cranfield University and HR Wallingford – WaSim

1D daily soil water balance model

3 layer soil water balance model

Incorporates daily rainfall and evapotranspiration, drainage design, crop type, soil type etc.

Simulates soil water storage and rates of input (net rainfall and irrigation) and output

(evapotranspiration and drainage).

Water table monitoring on each site – calibrate model

Installation of dip-wells and automated loggers

3. Hydrological Outputs

Inundation model

- Inundation area/volume/average depth/flow

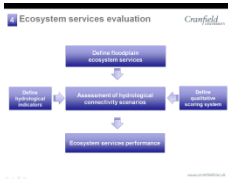
Water table model

- Water table level

Soil characterization

- Ponding duration

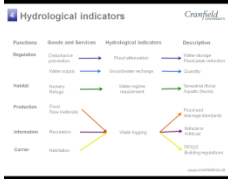
- Soil type



Qualitative evaluation system



Specifically looking at hydrological based floodplain ecosystem services.



Some hydrological indicators have no set standard to indicate positive or negative impact. Where there are no standards a 'relative system' is applied.

1. Flood attenuation: relative scale (more = positive and vice versa)

Level of attenuation (more = positive and vice versa)

Flood peak capping (more = positive and vice versa)

Flood return period (linked to ponding duration – good drainage = positive, poor drainage=negative)

2. Groundwater recharge: relative scale (more = positive impact and vice versa)

Water table level (level of increase – relative scale, higher level = more benefits and vice versa)

3. Water regime requirement: incorporates seasonal water table

Terrestrial (Flora) (Standards – target, likely change and threshold values)

Ecohydrological Guidelines: Lowland Wetland Plant Communities

B.D. Wheeler, D.J.G. Gowing, S.C. Shaw, J.O. Mountford, and R.P. Money, 2004. Ecohydrological Guidelines for Lowland Wetland Plant Communities (Eds. A.W. Brooks, P.V. Jose, and M.I. Whiteman,). Environment Agency (Anglian Region)

Habitat Matrix: based on soil and water regime: NVC - J.S.Rodwell – Mesotrophic Grassland/Open Vegetation/Swamp/Woodland

e.g. Floodplain meadow, hay meadow, inundation pasture, swamp, reedbed, alder, willow carr woodland

English Nature Research Reports, Number 598, Integrated washland management for flood defence and biodiversity, Morris, J.* , Hess, T.M.* , Gowing, D.J.* , Leeds-Harrison, P.B.* , Bannister, N.* , Wade, M.+ and Vivash, R.M.**

b. Aquatic (Fauna) – relative scale

Ponding duration

Flood return period

e.g. Low ponding duration and less water, less frequent return period, out of season inundation = bad for fish

4. Waterlogging:

a. Food (standards)

Flood and drainage standards for agriculture
Whole year and Summer (April – September)
Flood return period and water table level

b. Raw materials (lumber/fodder) something similar

c. Recreation: relative scale (dry type – lots of water = bad: no access) etc.

i. Natural – Parks (natural habitat) – dry and/or wet

ii. Artificial – Parks/playing grounds – dry

Playing fields – threshold of 0.25mbgl + capillary action level (based on soil type) to account for structural integrity of playing field (Cranfield University – Dr. Iain James)

d. Habitation (standards and relative system)

Planning and Development

PPS25

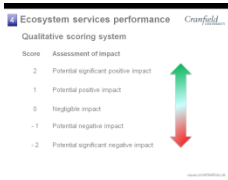
Flood return period

Area of inundation

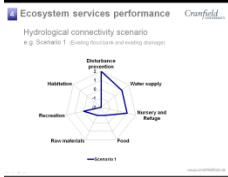
Building Regulations 2000 Part A structure

Minimum and threshold depth of strip foundations 0.45 and 0.75mbgl

Scoring values application



The graph is an example of how results will be displayed – indicating synergy and conflict etc.



1. Classification of ecosystem services site characteristics

Classify the site characteristics for each ecosystem service that you would expect to influence the performance of delivering the ecosystem service

2. Assessment of hydrological connectivity scenarios

Evaluate the influence of site characteristics on ecosystem services

3. Site characteristics performance

Rank the importance of site characteristics on ecosystem services

Relative ranking system

Decision support system framework – product of research

Scenario of how the framework – decision support system will work

Local planning authority

1. They want to deliver a range of ecosystem services in a particular area based on legal requirements, planning, stakeholder interests.

2. Framework will allow selection of land most suited to deliver desired multiple ecosystem services

3. Framework will indicate what hydrological connectivity management is necessary to enable delivery of the desired multiple ecosystem services.

