NATIONAL SCIENCE FOUNDATION
LTER NETWORK
LONG TERM ECOLOGICAL RESEARCH

Session on Core Data 2021

BONANZA CREEK LTER
Boreal Forest Ecology

Data Archiving, Core Data and MORE!

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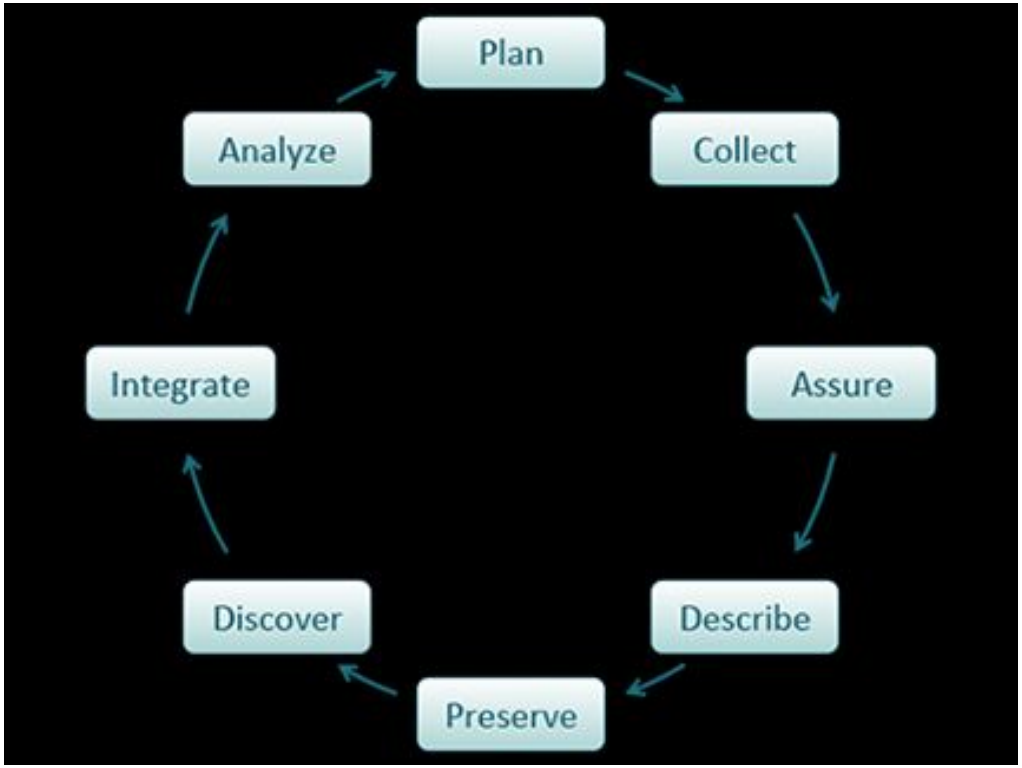
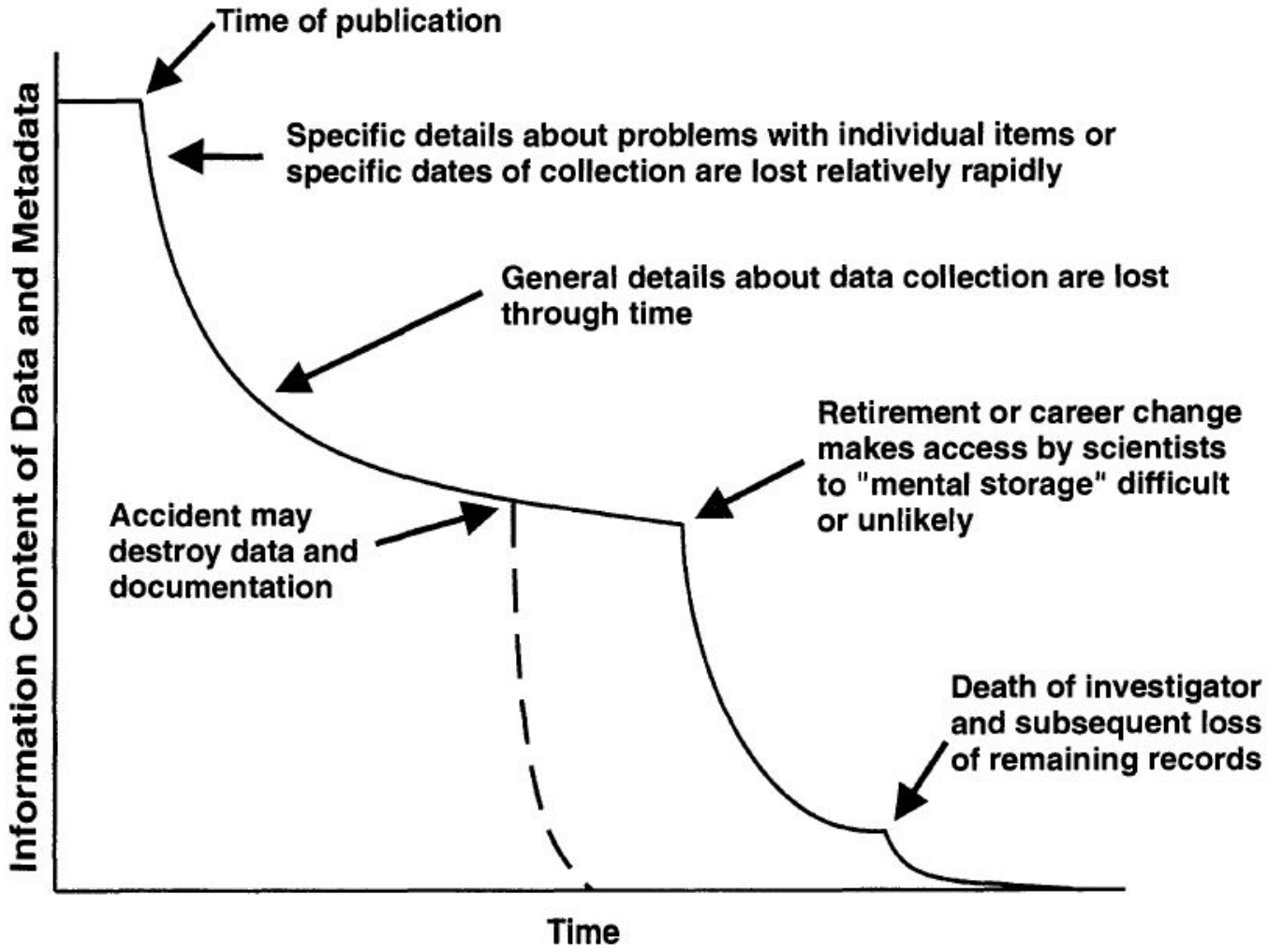
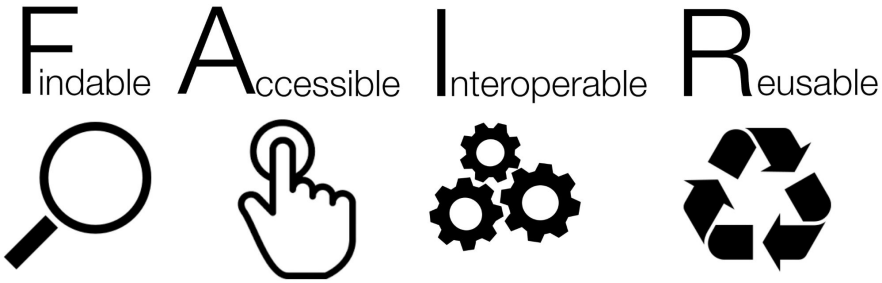
The Classic Data Life Cycle




Time of publication
Specific details about problems with individual items or specific dates of collection are lost relatively rapidly
General details about data collection are lost through time
Retirement or career change makes access by scientists to "mental storage" difficult or unlikely
Accident may destroy data and documentation
Death of investigator and subsequent loss of remaining records
Information Content of Data and Metadata
Time



- **Findable**
  - unique and persistent IDs
  - rich metadata
  - metadata specify the data ID
  - Registered, indexed, easy to find
- **Accessible**
  - retrieved by ID, read and accessed via standardised protocols
  - open, free communications protocol
  - Protocol allows for authentication
  - metadata are accessible even if data are no longer available
- **Interoperable**
  - Use standardised, documented, and accessible semantic descriptions
  - vocabularies follow FAIR principles
  - Qualified references
- **Reusable**
  - Plurality of relevant attributes
  - there are clear conditions for data usage
  - detailed provenance information
  - Meet domain-relevant standards

Transparency	To be transparent about specific repository services and data holdings that are verifiable by publicly accessible evidence.
Responsibility	To be responsible for ensuring the authenticity and integrity of data holdings and for the reliability and persistence of its service.
User Focus	To ensure that the data management norms and expectations of target user communities are met.
Sustainability	To sustain services and preserve data holdings for the long-term.
Technology	To provide infrastructure and capabilities to support secure, persistent, and reliable services.

LTER Core Research Areas

- **Primary Production** – Plant growth in most ecosystems forms the base or “primary” component of the food web. The amount and type of plant growth in an ecosystem helps to determine the amount and kind of animals (or “secondary” productivity) that can survive there.
- **Population Studies** – Populations of plants, animals, and microbes change in space and time, moving resources and restructuring ecological systems.
- **Movement of Organic Matter** – The entire ecosystem relies on the recycling of organic matter (and the nutrients it contains), including dead plants, animals, and other organisms. Decomposition of organic matter and its movement through the ecosystem is an important component of the food web.
- **Movement of Inorganic Matter** – Nitrogen, phosphorus, and other mineral nutrients are cycled through the ecosystem by way of decay and disturbances such as fire and flood. In excessive quantities nitrogen and other nutrients can have far-reaching and harmful effects on the environment.
- **Disturbance Patterns** – Disturbances often shape ecosystems by periodically reorganizing structure, allowing for significant changes in plant and animal populations and communities.

Two additional themes have emerged at LTER sites:

- **Land Use and Land Cover Change:** examine the human impact on land use and land-cover change in urban systems and relate these effects to ecosystem dynamics.
- **Human-Environment Interactions:** monitor the effects of human-environmental interactions in systems, develop appropriate tools (such as GIS) for data collection and analysis of socio-economic and ecosystem data, and develop integrated approaches to linking human and natural systems in an ecosystem environment.

BNZ Core Data Description

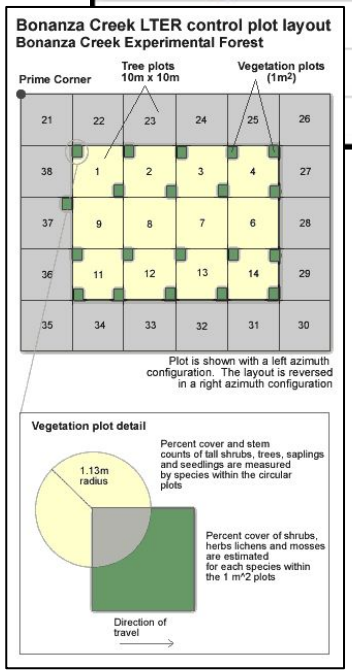
- A ‘core data’ file is one that addresses the central research objectives and hypotheses outlined in our LTER research proposals.

- Many of the ‘core data’ are composed of standard meteorological and ecological monitoring data that are used extensively in conjunction with various research projects and analyses.

- These core data also include several other data products that are collected either by the central BNZ research staff or by selected senior investigators who specialize in a particular discipline; such as hydrology, permafrost, population dynamics, and vegetation monitoring.

Core Data Overview (staff collected)

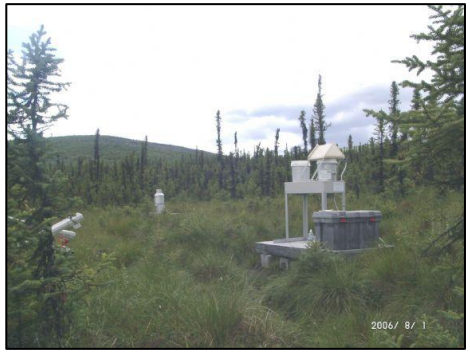
Veg Plots	DBH	Litter Tray	Seed Tray	Tree Bands	Tree Map	Frost Probes	MetStation
Percent cover, shrub and seedling transect	5 yr interval	Leaf Weight and Wood Weight	Count and Gremination	10 trees per species per plot	Azimuth and Distance	Active Layer Depth	Hourly Climate Measurements
	Fall	Spring	Spring	Fall	Once	Fall	Constant
		6 at each site	6 at each site				



- Veg Plots - Over 35 sites every 1-5yrs
- Tree Inventory - All sites every 5 years
- Tree Bands - 18 sites every year
- Litter & Seed Trays - Over 30 sites every year
- Frost Probing - 59 sites every year

	Site Inception	Method	Air Temp /Rel Hum	Soil Temp	Organic Soil Temp	Soil Moisture	Summe r Precip	Winter Precip (Snow Bucket)	Snow Pillow	Evapo ration	PAR	TUVR	Pyrano meter	Sun Photo meter	BP	Wind	LW/SW Radiation	Net Radio meter	Precip Chemi stry
			Height (m)	Depths (cm)	Height (cm)	Depths (cm)													
Main Climate Stations:																			
LTER1 - BCEF Upland	1988	Streaming	.5, 1.5	Surface, 0,5,10, 20,50, 100,200		5,10,20,50	X	X	X	X	X	X	X	X	X	X			
LTER2 - BCEF Floodplain	1988	Streaming	.5, 1.5	Surface, 0,5,10, 20,50, 100,200		5,10,20,50	X	X	X	X	X	X	X			X			
CRREL	1992 ?	Streaming	1,3,10,12	0-3.5m		Organic (5,5,10)	X								X	X	X	X	

- Three Primary Weather Stations
- Seven Additional Weather Stations
- Two Repeater Stations
- Sensor Network Server



Core Data Overview (investigator collected - historical)

- Hydrology and Water Chemistry Data
- Phenology Data
- Population Data

PI Oversight for BNZ “Core Data”

- **Primary Productivity**
  - Tree Band Data – *M.Mack*
  - Tree Inventory Data – *M.Mack*
  - Litter Tray Data – *M.Mack*

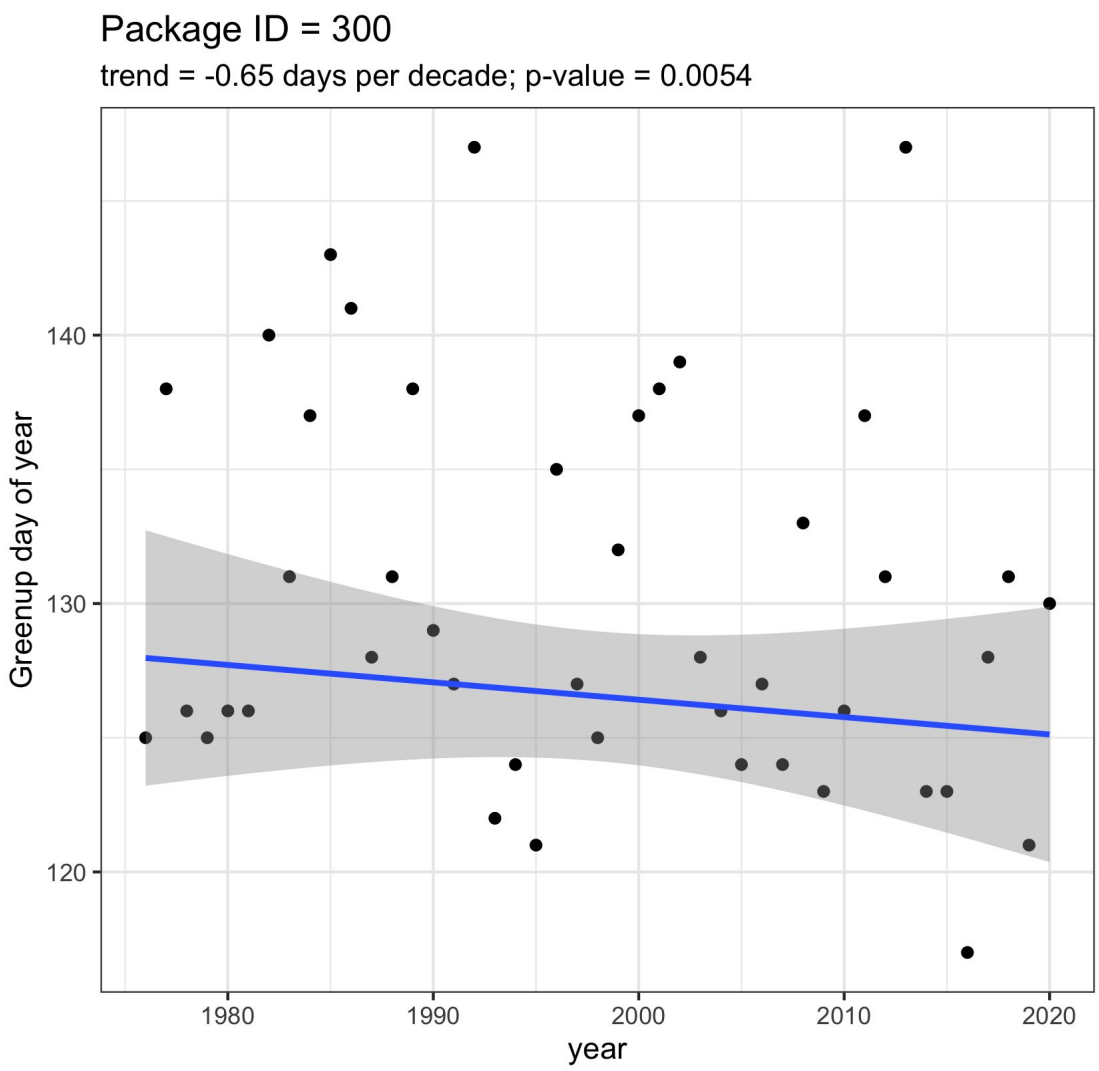
- **Vegetation Composition Data** – *T. Hollingsworth*

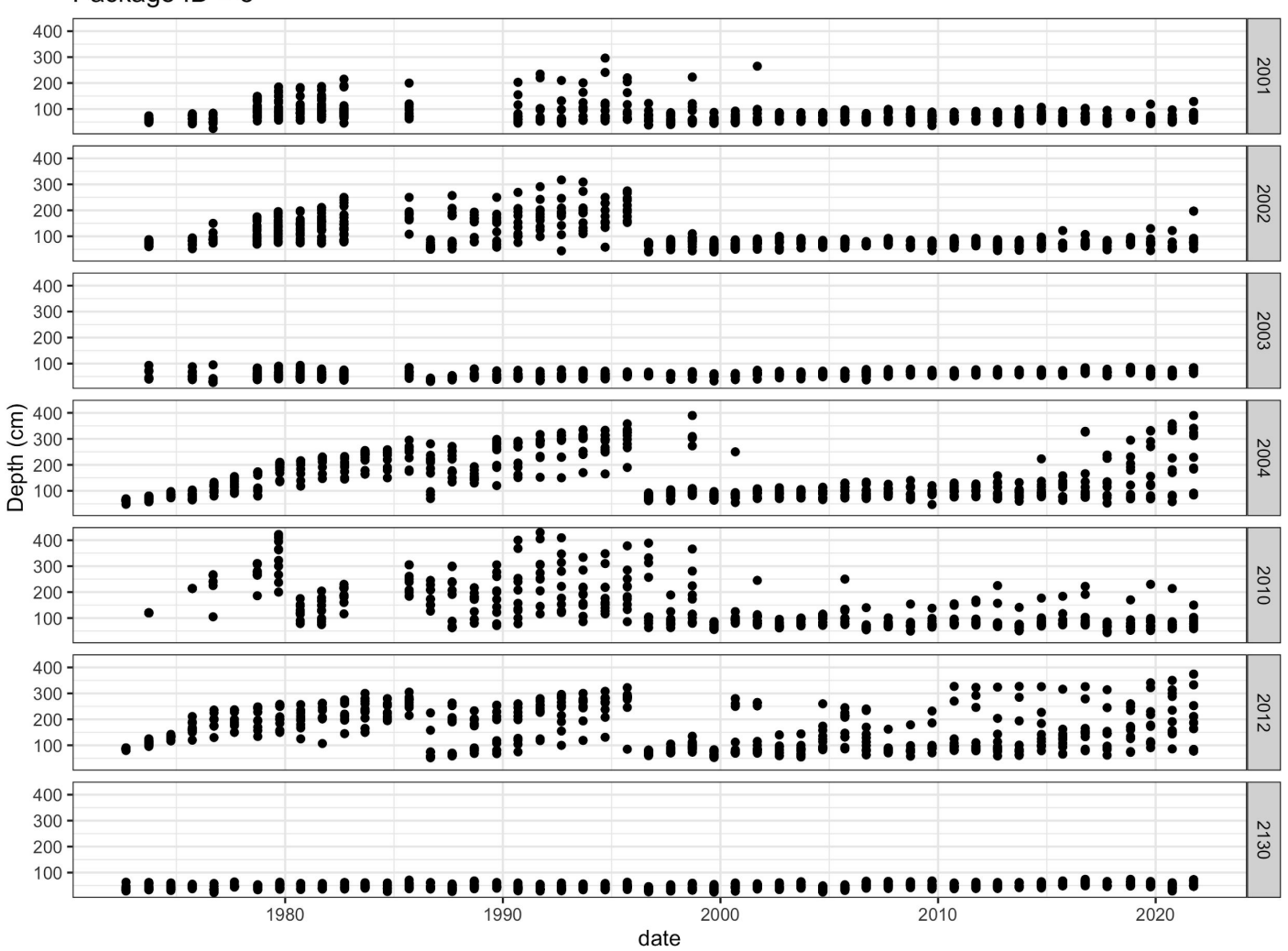
- **Population Data**
  - Insects – *D.Wagner*
  - Mammals – *K. Kielland*
  - Seed Tray Data – *Johnstone*

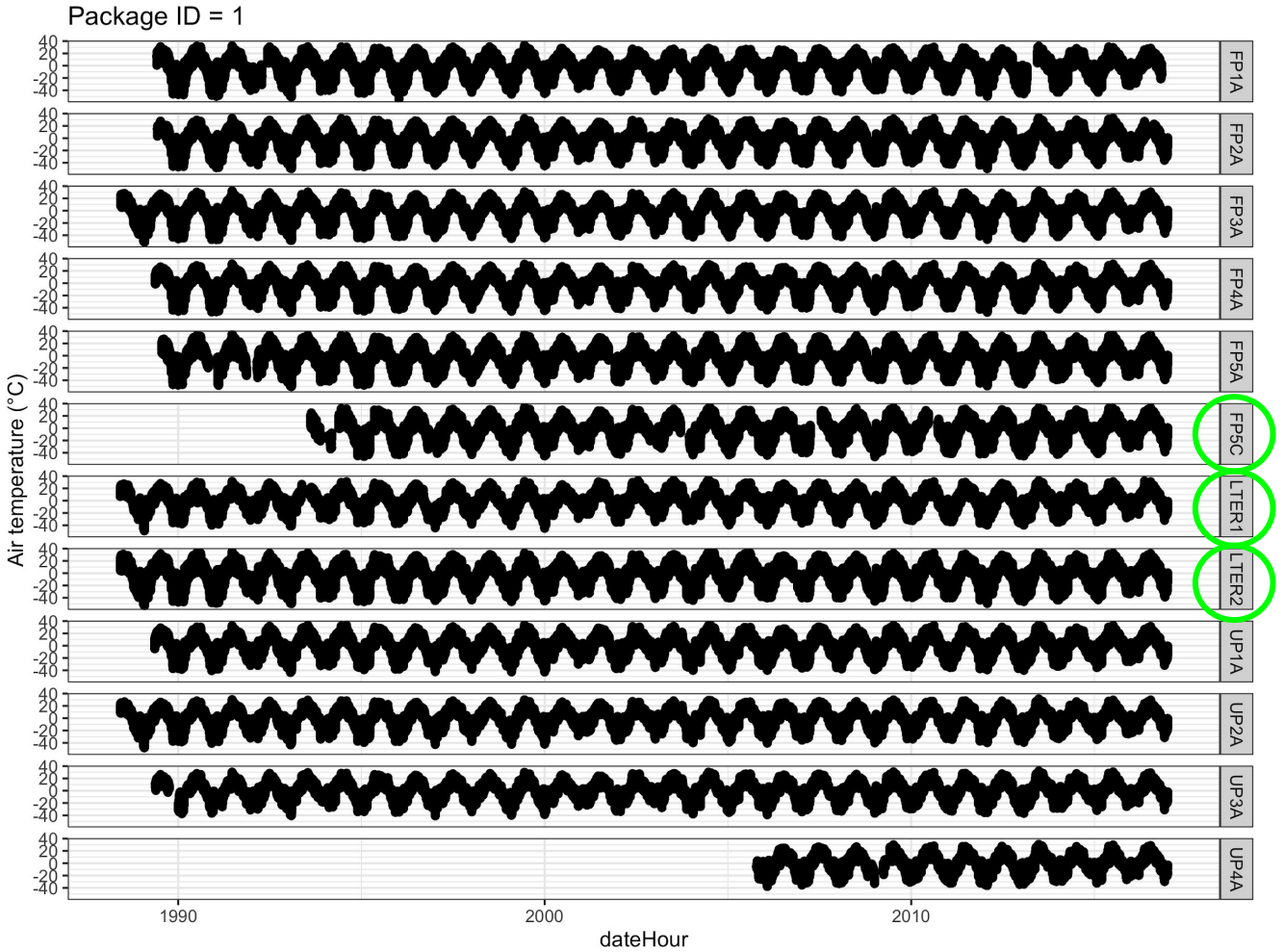
- **Hydrology and Chemistry Data**
  - Stream Hydrology and Chemistry Data - *J.Jones*
  - NRCS Snow Survey Data and NADP – *J.Jones*

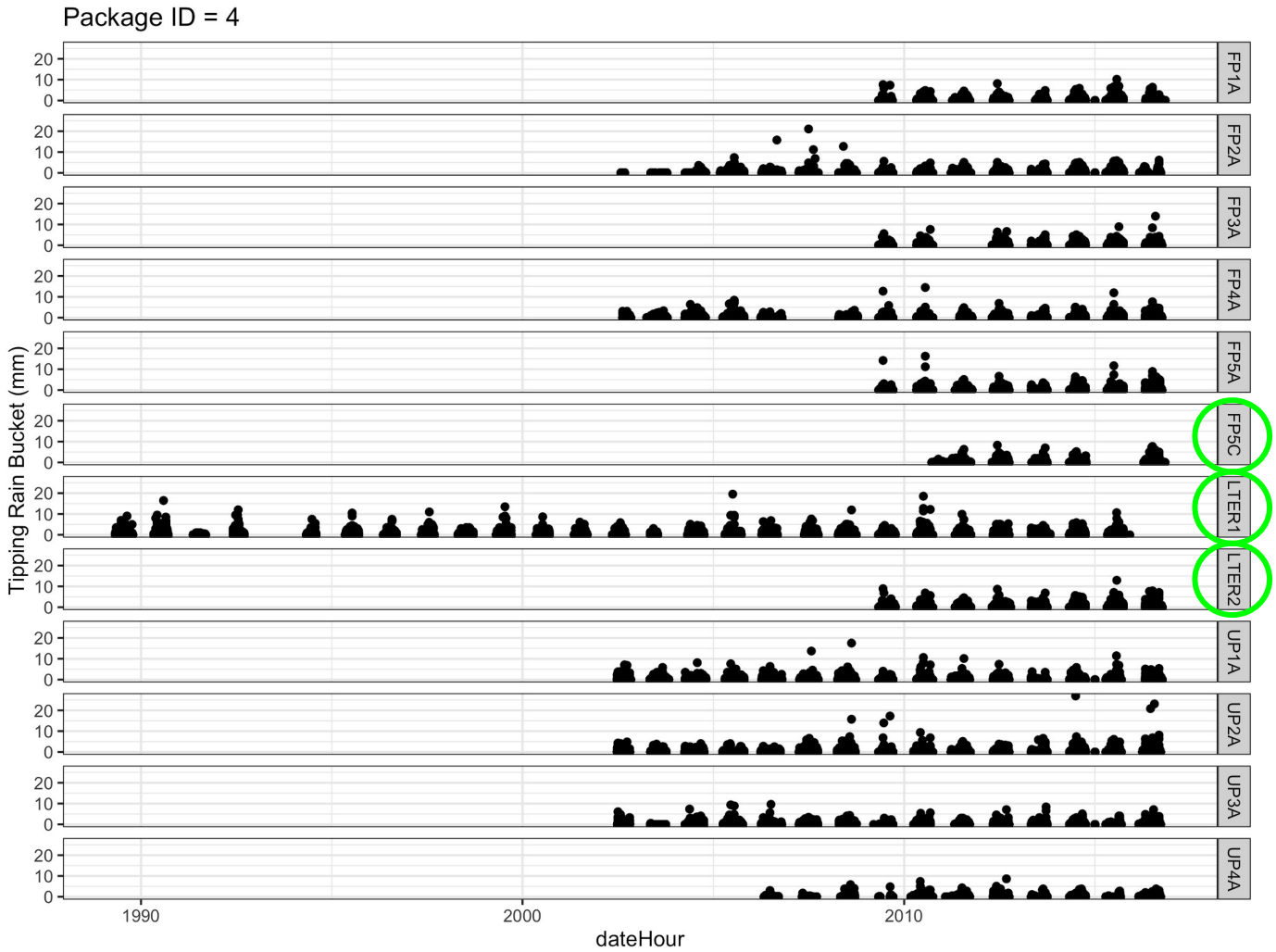
- **Soil Data**
  - *Active Layer Data and Soil Temp – Romanovsky*
  - *Soil Carbon and Soil Moisture – J.Hollingsworth & ???*

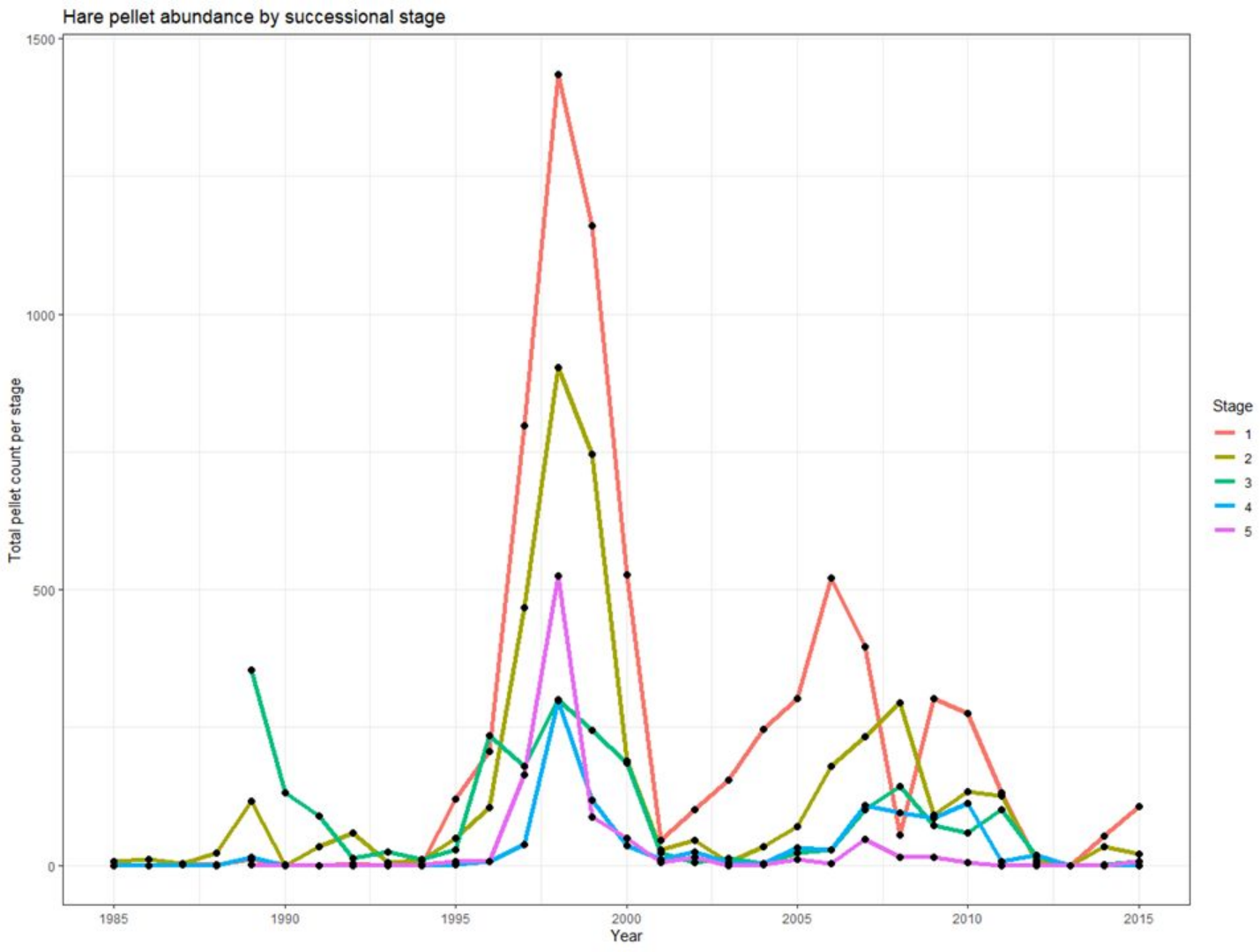
- **Climate Data**
  - *Precipitation (Rain and Snow) – J.Jones*
  - *Atmospheric (AirTemp/RH/BP/Solar Radiation/Sun Photometer/Wind) – J.Jones*


Package ID = 300
trend = -0.65 days per decade; p-value = 0.0054
Greenup day of year
140
130
120
1980
1990
2000
2010
2020
year


Package ID = 8
Depth (cm)
400
300
200
100
2001
2002
2003
2004
2010
2012
2130
1980
1990
2000
2010
2020
date


Package ID = 1
Air temperature (°C)
40
20
0
-20
-40
FP1A
FP2A
FP3A
FP4A
FP5A
FP5C
LTER1
LTER2
UP1A
UP2A
UP3A
UP4A
1990
2000
2010
dateHour


Package ID = 4
Tipping Rain Bucket (mm)
FP1A
FP2A
FP3A
FP4A
FP5A
FP5C
LTER1
LTER2
UP1A
UP2A
UP3A
UP4A
0
10
20
1990
2000
2010
dateHour


Hare pellet abundance by successional stage
Total pellet count per stage
1500
1000
500
0
1985
1990
1995
2000
2005
2010
2015
Year
Stage
1
2
3
4
5