

Active restoration measures at the stand and tree scale

Systematic Review to synthesize the knowledge base

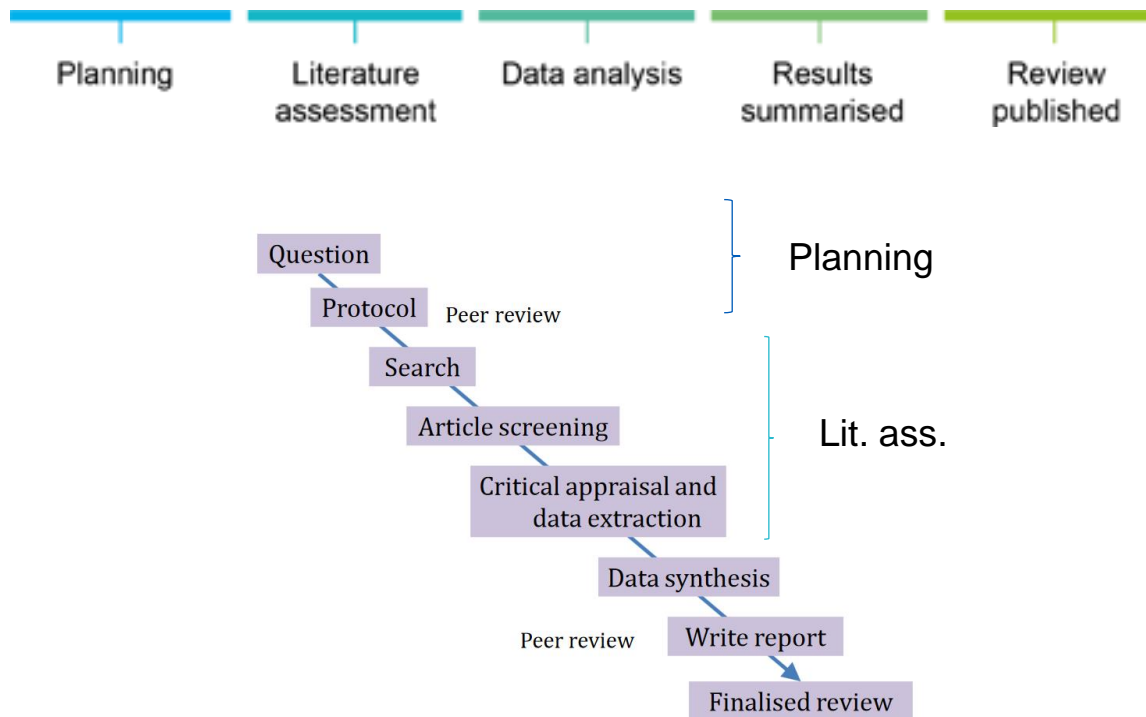
***Bengt Gunnar Jonsson
Dept of Natural Sciences
Mid Sweden University***

Mistra Council for Evidence-Based Environmental Management

- EviEM works for environmental management to be placed on a scientific foundation. Through systematic reviews of various environmental issues, we aim to improve the basis for decisions in Swedish environmental policy
- SR15 Prescribed burning
- SR13 Forest grazing
- SR12 Manipulation of dead wood
- SR6 Managing forest set-asides

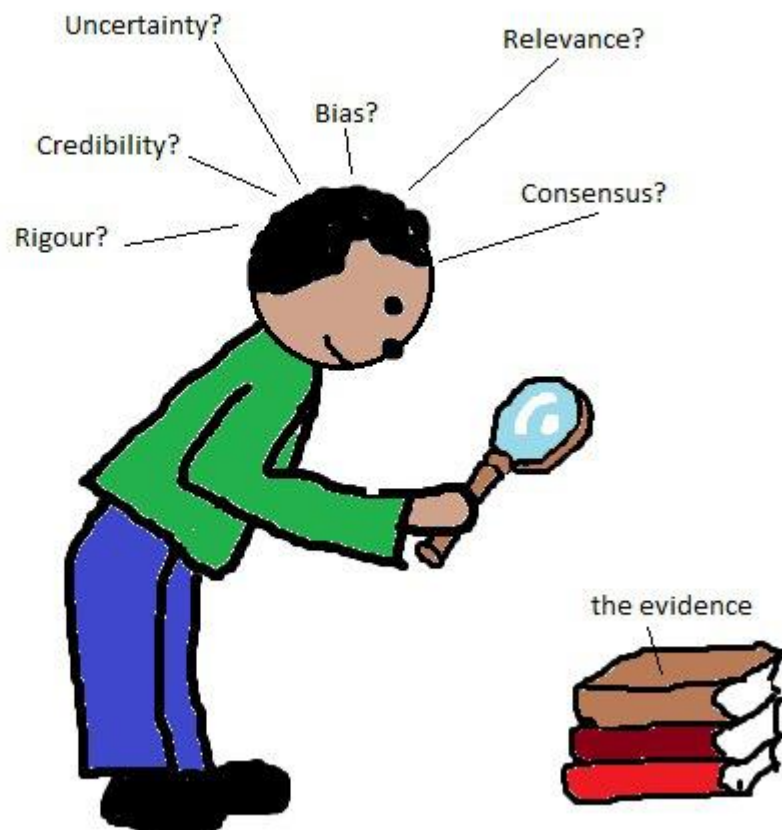


What is a systematic review



Synthesizing results
and knowledge
but not giving advice

Figure 2. Basic steps in conducting a CEE systematic review



What is impact of active management on biodiversity in boreal and temperate forests set aside for conservation or restoration?

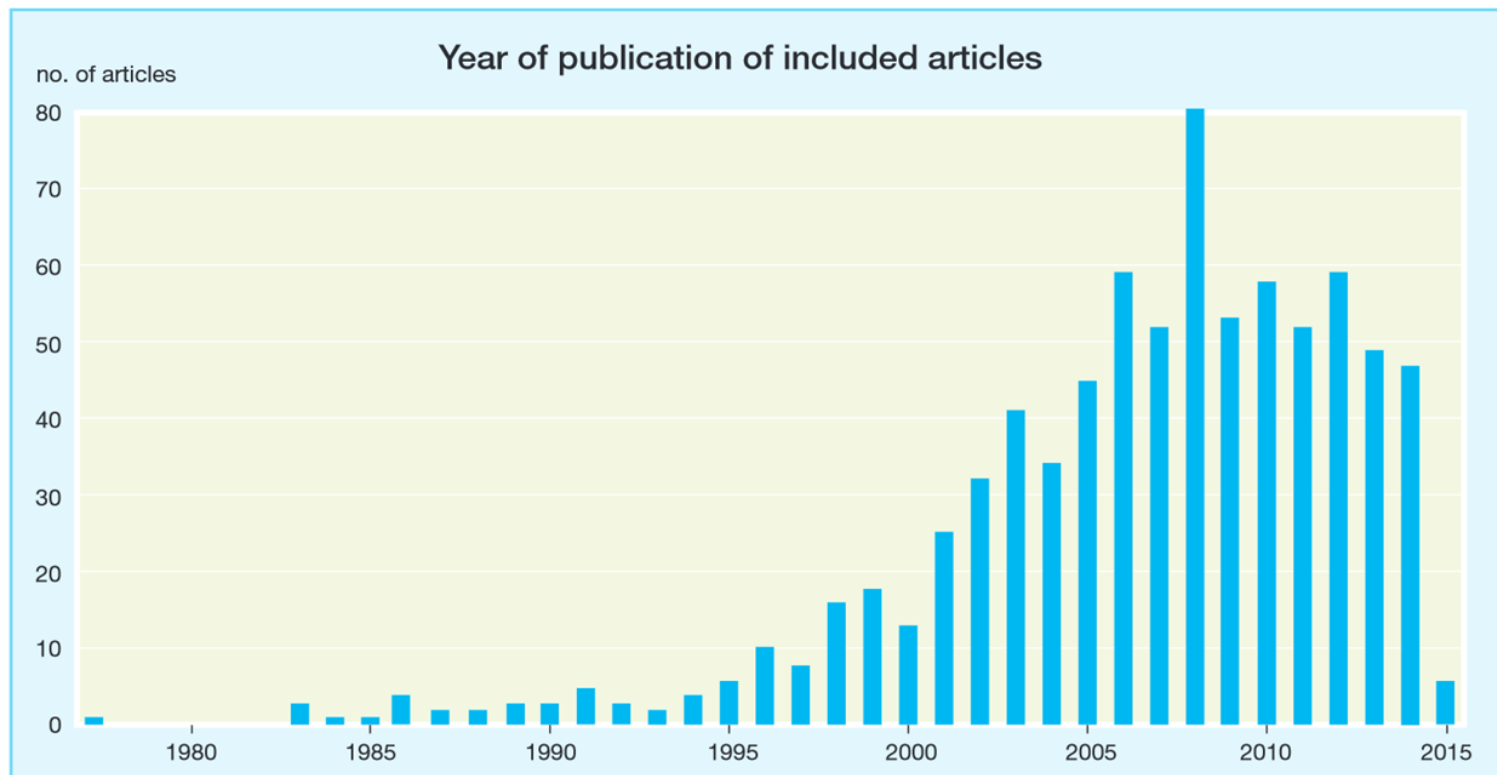


Systematic map published

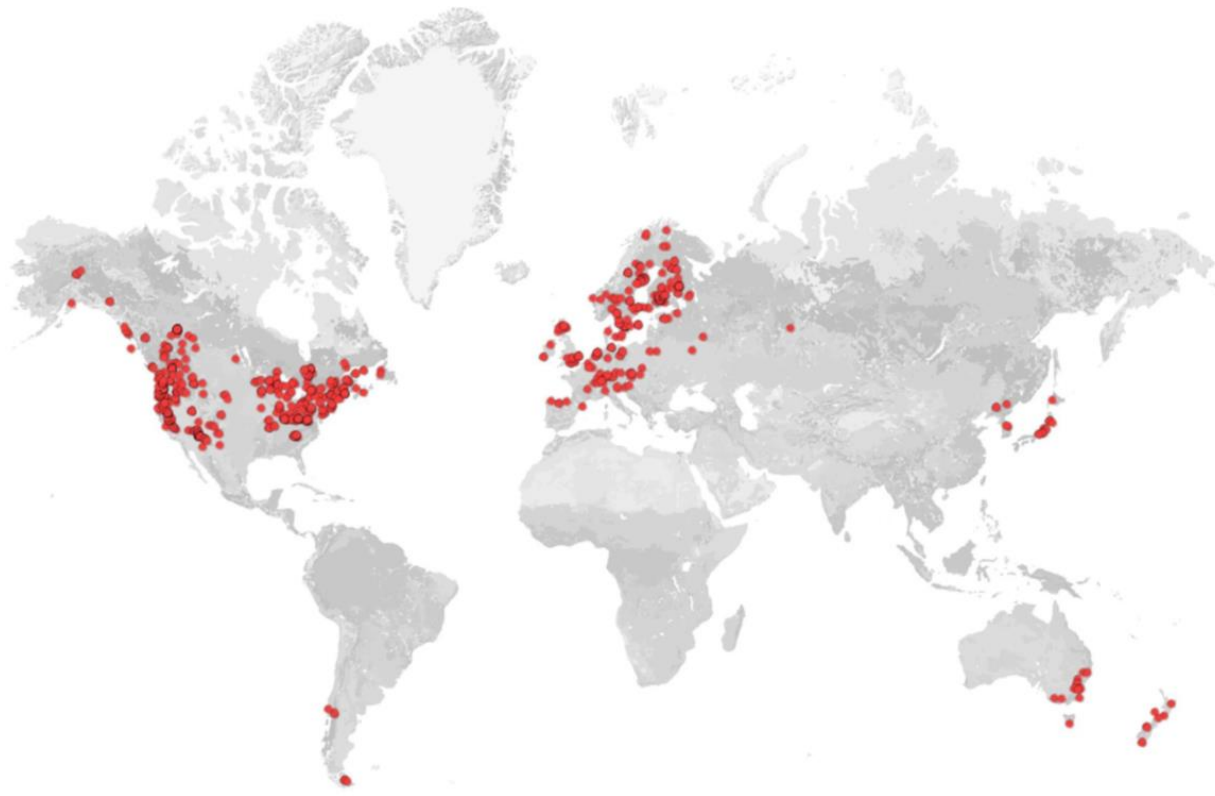
- **Population/subject:**
 - Boreal and temperate forests set aside for conservation or restoration of biodiversity
- **Intervention**
 - Active management (e.g. partial harvesting, thinning, prescribed burning, creation or addition of dead wood, grazing or exclusion from grazing, and introduction or removal of species)
- **Comparator**
 - Non-intervention or alternative types of intervention
- **Outcomes**
 - Measures or indicators of biodiversity

Bernes C., Jonsson BG., Junninen K., Löhmus A., Macdonald A., Müller J. & Sandström J. (2015) What is the impact of active management on biodiversity in boreal and temperate forests set aside for conservation or restoration? A systematic map. *Environmental Evidence*, 4: 25

Active research field – 800 papers/studies identified



Mainly European and North American studies



The most common interventions and outcomes

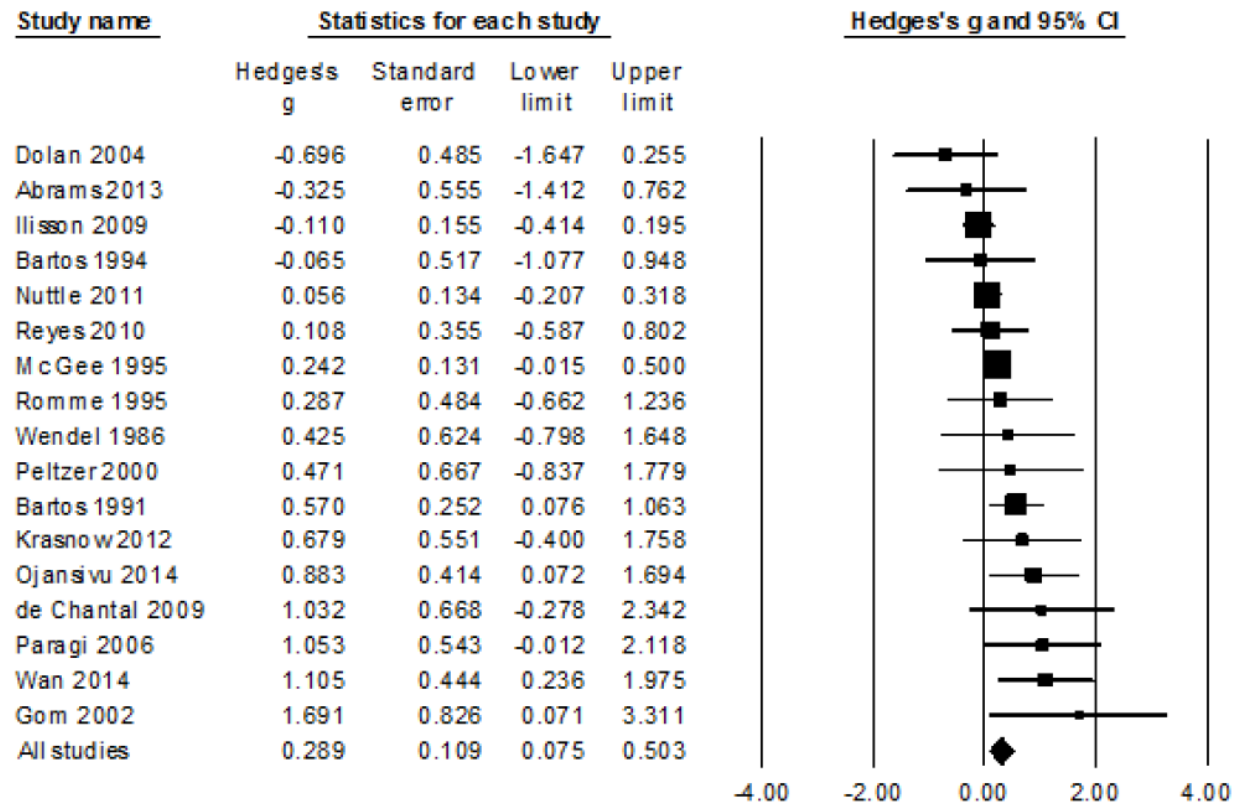
	Vertical structure	Dead wood	Vascular plants	Birds	Saproxyllic beetles	Ground beetles	Insects	Invasive species
Burning	34	60	105	31	34	16	10	30
Thinning	57	55	113	34	19	10	16	22
Partial harvest	48	73	113	49	29	25	38	15
Removal understorey	7	7	27	7	4	3	5	9
Creation of dead wood	2	16	9	6	31	1	6	0
Addition of dead wood	0	3	1	0	11	1	3	0
Grazing	18	8	110	13	2	15	18	15

Currently three full systematic reviews in progress

- What are the impacts of dead-wood manipulation on the biodiversity of temperate and boreal forests?
- What are the impacts of manipulating grazing and browsing by ungulates on plants and invertebrates in temperate and boreal forests?
- How does prescribed burning in temperate and boreal forests affect biodiversity? (non-target species focus)

Meta-Analysis – What does results look like?

Ex. deciduous tree
regeneration after fire



Matheis, M. 2015. Does restoration fire enhance the regeneration of deciduous trees in boreal forests? Master thesis

Meta-analysis effect modifiers

Modifier		-	±	+	Hedges g (CI)	Q (p, d.f.)	I ²	Sample size	k
Geographic location	East North America		X		0.026 (-0.173, 0.224)	11.710 (0.230, 9)	23.145	533; 304	7
	West North America			X	0.635 (0.322, 0.948)	5.834 (0.559, 7)	0.000	134; 65	8
	Finland			X	0.924 (0.235, 1.614)	1.551 (0.671, 3)	0.000	13; 13	2
Between level				X	14.385 (0.001, 2)				17
Forest association	Oak		X		0.039 (-0.286, 0.363)	9.937 (0.127, 6)	39.621	431; 197	5
	Aspen			X	0.428 (0.145, 0.711)	22.378 (0.071, 14)	37.439	249; 185	12
Between level			X		3.140 (0.076, 1)				17
Shade-tolerance	Tolerant	X			-1.059 (-2.219, -1.791)	1.228 (0.268, 1)	18.576	8; 5	2
	Intolerant			X	0.344 (0.124, 0.565)	25.493 (0.112, 18)	29.394	553; 261	16
Between level				X	5.434 (0.020, 1)				16*
Regeneration type	Generative		X		0.233 (-0.095, 0.560)	11.507 (0.118, 7)	39.167	434; 200	5
	Vegetative			X	0.562 (0.229, 0.896)	4.558 (0.602, 6)	0.000	112; 59	7
	Undefined		X		0.107 (-0.263, 0.477)	11.914 (0.103, 7)	41.243	138; 127	6
Between level			X		3.622 (0.163, 2)				17
Control treatment	Uncut		X		0.271 (-0.035, 0.577)	21.190 (0.048, 12)	43.369	510; 229	11
	Thinning		X		0.414 (-0.237, 1.065)	10.796 (0.095, 6)	44.423	27; 29	4
	Clearcut		X		0.113 (-0.189, 0.415)	5.798 (0.215, 4)	31.010	153; 134	4
Between level			X		0.923 (0.630, 2)				17
Fire type	Prescribed			X	0.296 (0.030, 0.561)	22.131 (0.076, 14)	36.739	540; 252	11
	Wild		X		0.250 (-0.136, 0.637)	11.310 (0.079, 6)	46.952	140; 130	6
Between level					0.036 (0.850, 1)				17
Time since disturbance	1. year			X	0.703 (0.082, 1.324)	7.01 (0.220, 5)	28.650	57; 22	5
	2-5 years			X	0.398 (0.022, 0.774)	18.607 (0.098, 12)	35.508	154; 71	11
	6-19 years		X		0.164 (-0.032, 0.360)	11.423 (0.179, 8)	29.969	570; 323	6
Between level			X		3.037 (0.219, 2)				17

Inoculation of wood fungi in living trees

- Based on fungal mycelia cultures
- Simple as long as you have the culture...
- Fungal colonizaiton on wood plugs in lab
- Wood plugs cored into tree – regular tree corer used
- *Laetiporus sulphureus* – Sulphur polypore (chicken of the woods)
 - On oak, bur also on other deciduous tres (Beech, Aspen etc)
 - Initiate red-rot cavities
- *Phellinus pini* – Pine polypore
 - Mainly on Pinus
 - Creating hollow rot and habitats for cavity nesters





THANK YOU!

(restoration fire in the Nature Reserve
Jämtgaveln, central Sweden)

...why not allow ourselves to manage for biodiversity?