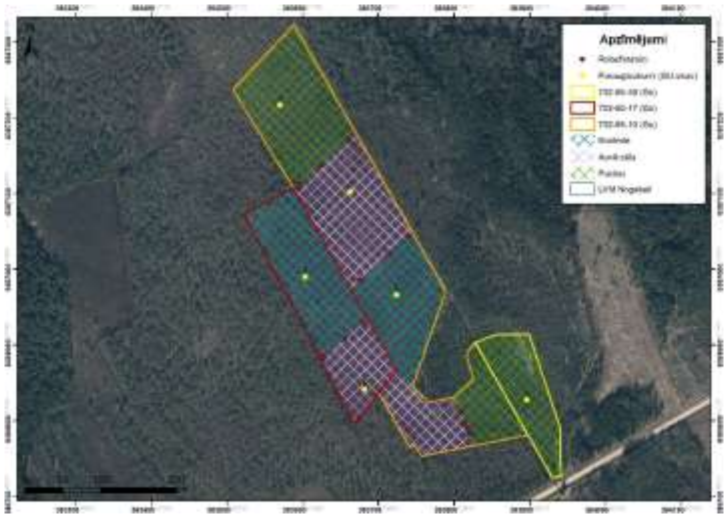
1. Pielikums "Parauglaukumu izvietojums ZK Rindas iecirkņa nogabalos"



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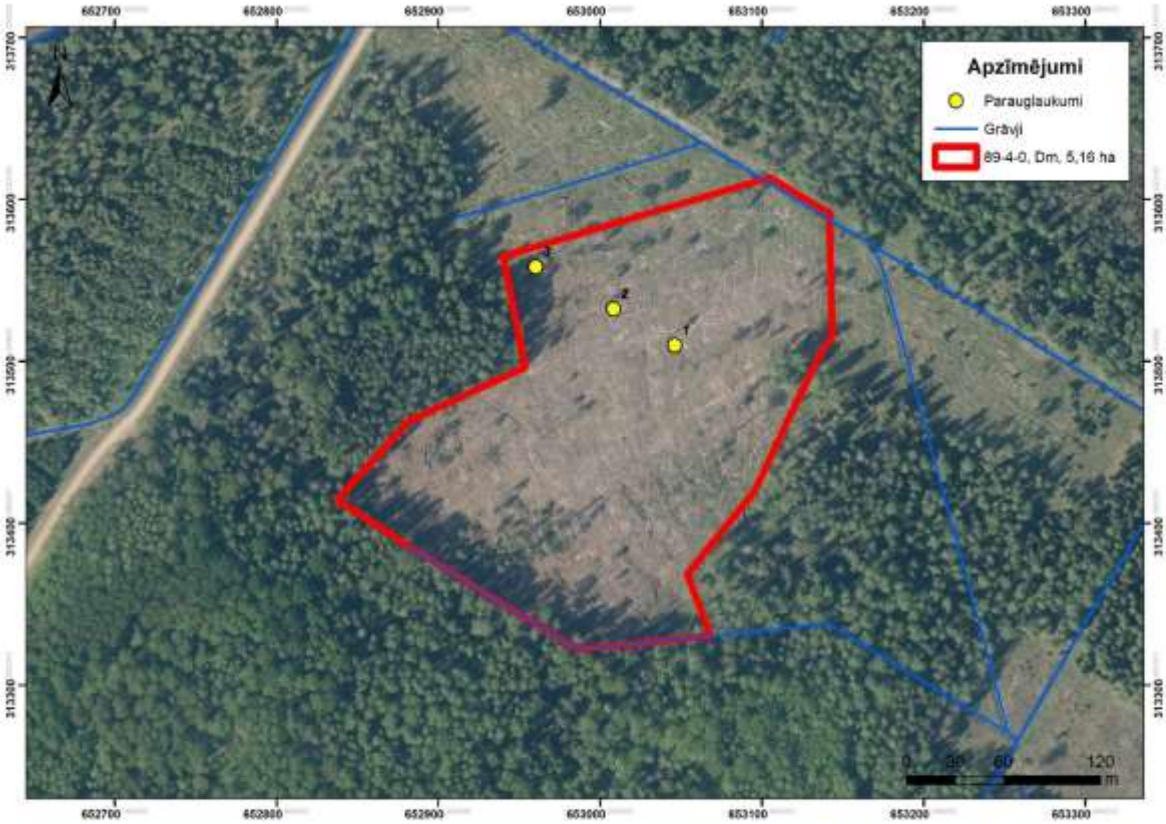

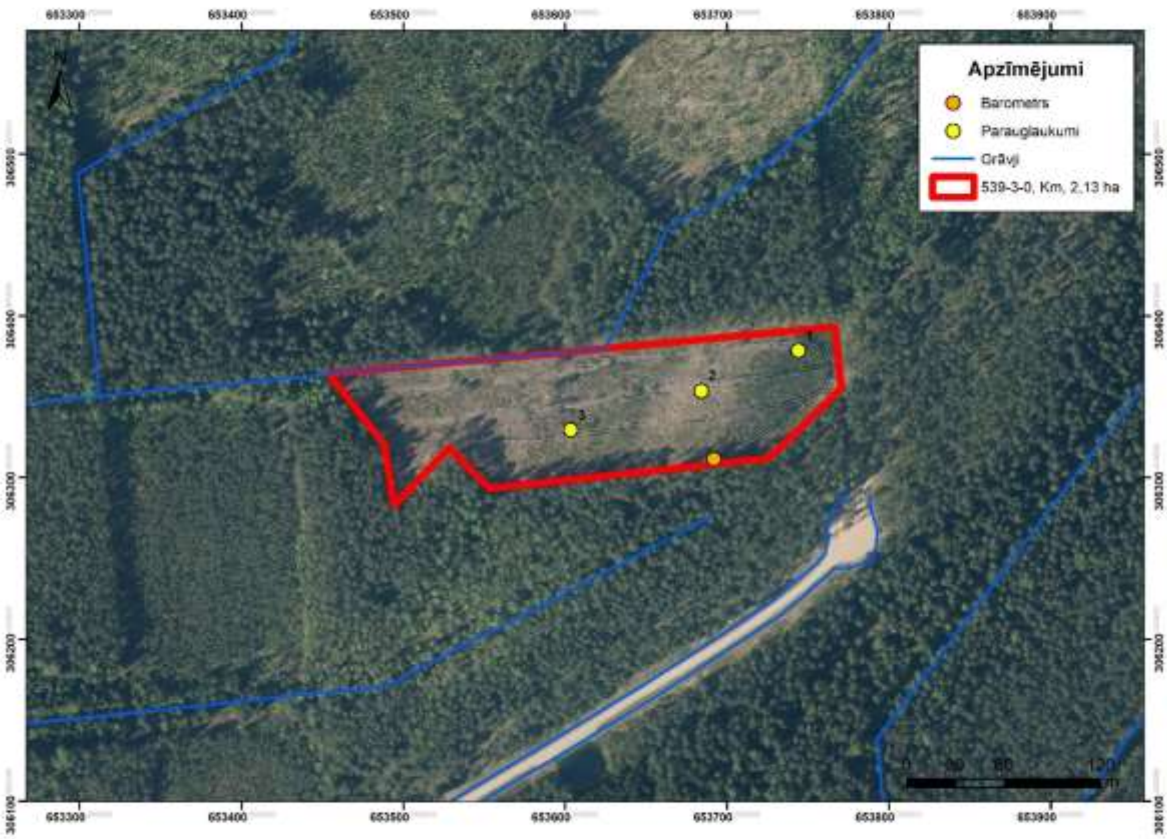

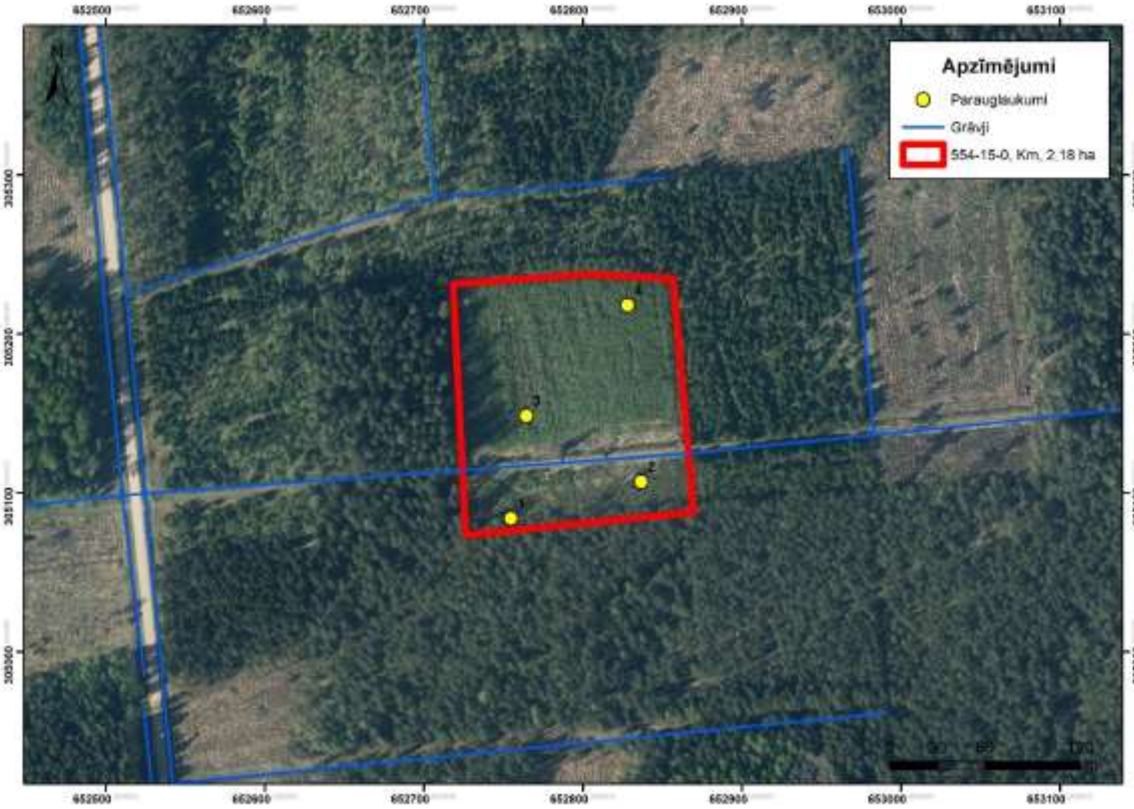
Apzīmējumi
Parauglaukumi
Grāvji
554-15-0, Km, 2,18 ha


Apzīmējumi
Parauglaukumi
Grāvji
624-9-0, Ks, 2,01 ha

3. Pielikums "Stenda ziņojumi konferencē "Advancing Silvicultural Technology", kas notika SLU zinātnes ciematā Umeja, Zviedrija (2023 . gada 22.-24. augustā) "

Productivity and cost evaluation between different repellents against browsing

Kārlis Dūmiņš[1], Dagnija Lazdiņa[1]

[1]Latvian State Forest Research Institute "Silava", Latvia
karlis.dumins@silava.lv

Context and objective. The winter season is the time when forestry experiences the most significant damage by deers as ungulates consume less valuable tree species during the summer period. The primary threat is the nibbling of the new shoots, which persists until the trees reach a height of about two meters. At this point, bark damages occur. Various management activities can be used to protect young trees, and the use of repellents that create an unpleasant odor or taste is a common method. This study aimed to compare the productivity and costs of the already in Latvia used repellents: Trico and Cervacol Extra, the new product - Epsom, as well as the Latvian-developed prototypes Jifte S and Jifte B, and the sheep's wool.

Methodology. The study assessed the application methods, productivity, and durability of the repellents in two-year-old and 5-8-year-old *Pinus sylvestris* stands, where top shoots or trunks were treated. While all repellents, except sheep wool, were used to protect shoots, Cervacol Extra was not used for trunk protection. Trico and Epsom were applied using a sprayer, while Cervacol Extra, Jifte S, Jifte B, and sheep wool were applied by hand. A total of 2697 pine shoots were protected, and 1155 tree trunks were protected. Trico cost 8.2 EUR/l, Epsom 14 EUR/l, and Cervacol Extra 2.62 EUR/kg, while there was no price for wool and Jifte.
The tree damages were assessed at the beginning of May

Picture 1. Used repellents a - Cervacol extra, b - Trico, c - Epsom, d -Jifte B, e - Jifte S, F - Sheep wool.

Picture 2. Design of the Study site.

Repellent	Tree part	Tree*s-1	Trees per hour	Consumption per tree (ml) *	Cost for 1000 trees	Damaged trees %
Trico	Shoot	3,78	952	6,4	54	29,7
Epsom	Shoot	4,6	783	4,4	61,5	27,4
Cervacol	Shoot	5,31	678	3,8	17	50
Jifte B	Shoot	8,57	420	8,9		44,2
Jifte S	Shoot	3,35	1075	15,1		47,5
Trico	Bark	9,53	378	24,1	197,5	6
Epsom	Bark	12,19	295	20,3	294	11,5
Jifte B	Bark	21,47	168	119,6		7,4
Sheep wool*	Bark	164	22	11,5 g		-
Wobro**	Bark	138	26	134 g		

Table 1. Productivity and proportion of damaged trees.

Results. Results showed that Cervacol Extra was the cheapest for shoot protection, but with this product, fewer trees can be protected within an hour (678) compared to Trico (952) or Epsom (783). Despite Epsom being more expensive than Trico, it could be sprayed more effectively, resulting in similar costs for protecting a single tree. Jifte B required almost twice as much time (420 trees per hour) and considerably more product than other repellents, while Jifte S showed similar or better productivity (1075 trees per hour) compared to other repellents, but more product was required.
Regarding trunk protection, similar patterns were observed. The longest time and most product required for applying Jifti B (168 trees per hour), while Epsom (295 trees per hour) using the same sprayers required more time than Trico (378 trees per hour). Assuming 1000 trees are protected per hectare, the difference was 31 minutes. Sheep wool protection was the least productive compared to spray products, with an average of 22 trees per hour and 11.5 grams of sheep wool needed per tree, but it could be applied regardless of weather conditions, which is the primary drawback of other products.
Regarding tree protection, the most effective ones are Trico and Epsom, with quite similar results. However, for half of the trees treated with Cervacol, the top shoots were browsed.
Bark injuries were rarer than top shoot, and none of the trees treated with Trico had any bark damages.

Picture 3. Bark or top shoot damaged by ungulates.

Conclusions:
Trico is the fastest method for treating trees.
Cervacol Extra is the most cost-effective when applied by hand directly to the top shoot.
Jifte S is a fast method, but it requires a significant amount of product.
Jifte B had the lowest productivity for protecting both shoots and trunks.
Sheep wool is the least productive but can be applied regardless of weather conditions.
The best protection was achieved by Epsom and Trico but Cervacol was the least effective.

Acknowledgements: [illegible]

Evaluation of different soil preparation methods (spot mounds, inverted turfs) in mineral soils

Toms Štāls[1], Kristaps Makovskis[1], Dagnija Lazdiņa[1]
[1]Latvian State Forest Research Institute "Silava", Latvia
toms.stals@silava.lv

Context. Soil preparation is crucial for successful tree planting in forestry, impacting growth and survival. It enables roots to establish and access essential nutrients, resulting in healthier and more resilient trees. Additionally, proper soil preparation helps control competing vegetation and enhances resistance against pests and diseases.

Objective. This study aims to compare the productivity and quality of soil preparation techniques: classical mounding and inverted tur. The research was conducted in four forest areas (previously stagnant pine stands) located in northwestern Latvia, namely *Cladinoso-callunosa*, *Myrtillosa*, and *Callunoso-sphagnosa*. Each area was divided into three groups: classical mounding, inverted turf and a control area to assess the possibility of regeneration without soil preparation.

Methodology. To evaluate the efficiency of classical mounding and inverted turf methods, work hours of soil preparation were recorded using the SDI 1.2 chronometry program. Activities related to the planting sites, such as movement, manipulator movement, mound preparation, other activities, and breaks, were documented using previously recorded videos from the tractor cabin. Site preparation involved the use of an excavator with a standard bucket. All sites were reforested with pine seedlings.

*Picture 2. **Different working conditions (Callunoso-sphagnosa).***

The quality of spot mounds and inverted turf was assessed through the sample plot method. Two 50 m² sample plots were set up in each area. For classical mounding, measurements included the length, width, and height of the mound, as well as the width, length, and depth of the pit. In the case of inverted turf, the width and length of the planting site were measured. After the areas were regenerated in spring 2022, three 50 m² sample plots were established in each area to evaluate seedling survival in the fall.

*Table 1. **Planting density and tree survival rate.***

Forest area	Number of trees planted, ha⁻¹		Survival rate of trees, %	
	Classical mounds	Inverted turf	Classical mounds	Inverted turf
702-103-39	1000	1000	100	100
702-127-5	1000	1200	80	100
702-65-10	600	1400	100	100
702-65-17	1000	1200	100	100
Average	900	1200	95	100

Scan QR code to see video from excavator cabin

*Picture 1. **Classical mound (to the left) and inverted turf (to the right).***

Results. The study revealed that the average preparation time for one classical mound was 15.2 seconds, while for inverted turf, it was 19.8 seconds, resulting in a 23.5% longer duration. When preparing 2,000 planting spots, inverted turf required an additional 2.6 hours compared to classical mounding. Classical mounding had an average of 900 mounds per hectare, whereas inverted turf had 1,200, representing a 33% increase in planting spots. The scarified area was 37% for inverted turf, 19% for classical mounding, and 33% for classical mounding with a pit. If 2,000 planting spots were prepared per hectare, the scarified area for spot mounds would be 46%, while for inverted turf, it would be 43% of the total area, which indicates a negligible difference. Notably, survival rates after the first growing season were 100% in almost all areas and forest types.

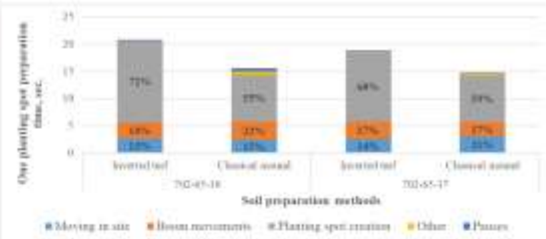

*Figure 1. **Working time spent on different planting spot preparation methods.***

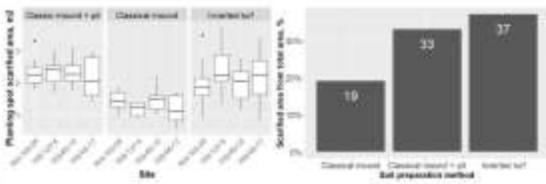

*Figure 2. **Scarified area of planting spots (m²) based on site (different forest types) and soil preperation approach.***

Conclusions. The results demonstrate that both soil preparation methods have their advantages and disadvantages. Classical mounding allows for faster preparation but offers fewer planting spots per hectare compared to inverted turf. Further evaluations are necessary to assess the effectiveness and quality of the inverted turf method. Future studies will continue to monitor the long-term survival and growth rates of planted trees, as well as the vegetation cover associated with each soil preparation method.

Acknowledgements: The study is being carried out within the framework of the Latvian state Forest project "Working methods and technologies for restoration, planting, care and protection of forest stand" [illegible]

4. Pielikums "Briežu dzimtas dzīvnieku ekskrementu kaudzīšu DNS sekvencēšanas rezultātā noteiktās augu dzimtas un to īpatsvars paraugos""

Dzimtas nosaukums	**Alnis**	**Staltbriedis**	**Stirna**
Actinidiaceae	<0.01	<0.01	0
Adoxaceae	0.01-0.10	0.01-0.10	<0.01
Amaryllidaceae	<0.01	0.01-0.10	0.01-0.10
Aneuraceae	0	<0.01	0
Apiaceae	0.11-1.00	0.01-0.10	0.01-0.10
Araceae	0	<0.01	<0.01
Araliaceae	0	<0.01	0
Arecaceae	<0.01	<0.01	0
Aristolochiaceae	0.11-1.00	0.11-1.00	<0.01
Asparagaceae	0	<0.01	0
Asteraceae	1.01-2.00	0.11-1.00	2.01-10.00
Athyriaceae	<0.01	<0.01	<0.01
Balsaminaceae	0	<0.01	0
Berberidaceae	0	<0.01	0
Betulaceae	>10.01	>10.01	>10.01
Blechnaceae	2.01-10.00	1.01-2.00	0.11-1.00
Boraginaceae	0	<0.01	0
Brachytheciaceae	0	<0.01	0
Brassicaceae	0.11-1.00	0.11-1.00	0.11-1.00
Bromeliaceae	<0.01	<0.01	0
Cactaceae	0	<0.01	0
Cannabaceae	1.01-2.00	2.01-10.00	0.11-1.00
Caprifoliaceae	<0.01	0.11-1.00	0
Caryophyllaceae	0.11-1.00	0.01-0.10	0
Celastraceae	0.11-1.00	0.01-0.10	0.11-1.00
Chloranthaceae	0	<0.01	<0.01
Clusiaceae	<0.01	<0.01	0
Colchicaceae	0	<0.01	0
Cupressaceae	<0.01	0	0
Cyperaceae	>10.01	>10.01	>10.01
Dennstaedtiaceae	0	<0.01	0
Dioscoreaceae	<0.01	<0.01	0
Echinodiaceae	0	<0.01	<0.01
Ehretiaceae	0	0.01-0.10	0
Elaeagnaceae	0	0	<0.01
Ericaceae	>10.01	2.01-10.00	>10.01
Euphorbiaceae	0	<0.01	0
Eupteleaceae	<0.01	<0.01	0
Fabaceae	0.11-1.00	0.01-0.10	1.01-2.00
Fagaceae	0.11-1.00	0.11-1.00	0.01-0.10
Dzimtas nosaukums	**Alnis**	**Staltbriedis**	**Stirna**
Flatbergiaceae	0	0	<0.01
Funariaceae	0	<0.01	0

Gentianaceae	0.01-0.10	0.01-0.10	0.01-0.10
Geraniaceae	<0.01	0.01-0.10	<0.01
Gesneriaceae	0	<0.01	0
Grimmiaceae	<0.01	0.11-1.00	<0.01
Gunneraceae	0	<0.01	0
Hamamelidaceae	<0.01	<0.01	<0.01
Hydrangeaceae	<0.01	<0.01	0.01-0.10
Hypoxidaceae	1.01-2.00	2.01-10.00	0.11-1.00
Iridaceae	<0.01	<0.01	0
Juglandaceae	<0.01	<0.01	<0.01
Lamiaceae	0.01-0.10	0.01-0.10	0.01-0.10
Lauraceae	0	<0.01	<0.01
Leptostomataceae	0	<0.01	0
Leucobryaceae	0	<0.01	0
Leucomiaceae	<0.01	<0.01	<0.01
Liliaceae	<0.01	0.01-0.10	<0.01
Loasaceae	0.11-1.00	0.11-1.00	0.01-0.10
Lygodiaceae	<0.01	<0.01	<0.01
Lythraceae	<0.01	0.01-0.10	0
Malvaceae	0.01-0.10	0.11-1.00	0.01-0.10
Melanthiaceae	2.01-10.00	0.11-1.00	0.01-0.10
Melastomataceae	0	<0.01	0
Meliaceae	0	<0.01	<0.01
Moraceae	0.11-1.00	<0.01	<0.01
Myrtaceae	<0.01	<0.01	0
Nartheciaceae	0.01-0.10	0.01-0.10	<0.01
Neckeraceae	<0.01	0.01-0.10	0.01-0.10
Nyctaginaceae	0.11-1.00	0.01-0.10	<0.01
Oleaceae	0	<0.01	<0.01
Orchidaceae	0.01-0.10	0.01-0.10	<0.01
Orobanchaceae	0	<0.01	<0.01
Orthotrichaceae	<0.01	<0.01	<0.01
Oxalidaceae	0.11-1.00	0.01-0.10	<0.01
Papaveraceae	<0.01	<0.01	<0.01
Passifloraceae	0.01-0.10	0.01-0.10	0.01-0.10
Paulowniaceae	<0.01	0.01-0.10	0.01-0.10
Pentaphylacaceae	<0.01	<0.01	<0.01
Petiveriaceae	0	<0.01	0
Phrymaceae	0	<0.01	0
Pinaceae	>10.01	>10.01	>10.01
Dzimtas nosaukums	**Alnis**	**Staltbriedis**	**Stirna**
Plagiotheciaceae	0	<0.01	<0.01
Plantaginaceae	<0.01	<0.01	0.01-0.10
Poaceae	1.01-2.00	1.01-2.00	2.01-10.00
Podostemaceae	0	<0.01	0.01-0.10
Polemoniaceae	<0.01	<0.01	<0.01

Polygonaceae	0.01-0.10	0.01-0.10	0.01-0.10
Polytrichaceae	0	0	<0.01
Potamogetonaceae	0	<0.01	0
Primulaceae	0.01-0.10	0.11-1.00	2.01-10.00
Proteaceae	0	0.01-0.10	0
Ptychomitriaceae	<0.01	<0.01	<0.01
Ranunculaceae	<0.01	0.01-0.10	<0.01
Restionaceae	0	<0.01	0
Rhamnaceae	<0.01	<0.01	0
Rosaceae	2.01-10.00	10.583946	2.01-10.00
Rubiaceae	<0.01	<0.01	<0.01
Rutaceae	0	<0.01	<0.01
Salicaceae	2.01-10.00	2.01-10.00	2.01-10.00
Santalaceae	<0.01	0.01-0.10	0
Sapindaceae	0.01-0.10	<0.01	0
Saururaceae	<0.01	<0.01	0
Saxifragaceae	1.01-2.00	0.11-1.00	0.01-0.10
Schisandraceae	0.01-0.10	0.11-1.00	<0.01
Scrophulariaceae	<0.01	<0.01	0
Solanaceae	<0.01	0.01-0.10	<0.01
Stemonaceae	0	<0.01	0
Styracaceae	<0.01	<0.01	0
Timmiaceae	0	<0.01	0
Tofieldiaceae	0	<0.01	0
Typhaceae	0	0.01-0.10	0
Ulmaceae	0.01-0.10	0.01-0.10	0.11-1.00
Urticaceae	<0.01	<0.01	0
Verbenaceae	<0.01	<0.01	0
Vitaceae	0.01-0.10	<0.01	<0.01
Zygophyllaceae	0.01-0.10	0.01-0.10	0.01-0.10