8. Region 2 – Upper North East New South Wales

8.1. Description

The Upper North East New South Wales region (UNE NSW) covers approximately 7,240,000 ha of land between latitudes 24°30' in the north and 31° in the south and longitudes 153°30' in the east and 151° in the west. The region is bounded by the Queensland-New South Wales border in the north and an arbitrary boundary with the Lower North East NSW region in the south. The eastern boundary is formed by the Coral and Tasman Seas and the western boundary extends to the western edge of the Nandewar Bioregion (Thackway and Cresswell 1995). Four IBRA bioregions are found within the UNE NSW region. East of the escarpment the South Eastern Qld Bioregion is in the north and the NSW North Coast is in the south. To the immediate west of the escarpment is the New England Tablelands which joins the Nandewar Bioregion to the west. The eastern portion of the region falls within the Northern Rivers CMA. The western portion primarily falls within the Border Rivers/Gwydir CMA and a portion of the Namoi CMA occurs in the south west corner.

Long beaches alternating with rocky headlands extend the length of the coastline of the UNE NSW region. These are backed by coastal lowlands and low hills of Quaternary alluvial and marine sediments. Unconsolidated sands, silts and clays occur in low lying areas and fertile floodplains of different width occur along the major river valleys and streams. Low foothills and ranges give rise to a steep, deeply bisected escarpment which separates the coastal lowlands from the hilly plateau of the tablelands. Deep granite gorges and wide basalt flows have been cut by erosion. The tablelands is a stepped landscape of hills and plains on Permian sedimentary rocks and granites at 600 – 1500m. Extensive Tertiary basalt flows are interspersed. West-facing, gently undulating slopes on Palaeozoic sediments run along the western edge of the tablelands. Here shallow and stony sandy loams are associated with sediments and granites. Red brown earth and black clays are associated with volcanic substrates. Significant areas of basalt include the Nandewar shield volcano (Mt Kaputar). Alluvial soils of high fertility occur at low elevations along valley floors. The northern boundary of the UNE NSW region is dominated by steep escarpments and heavily bisected ranges of the Tweed shield volcano, including the largely east-west running Border Ranges and the Mt Warning plug and ring dykes. The extensive Tweed erosion caldera and eroded lava flows of the Lismore plateau support soils of moderate to high fertility.

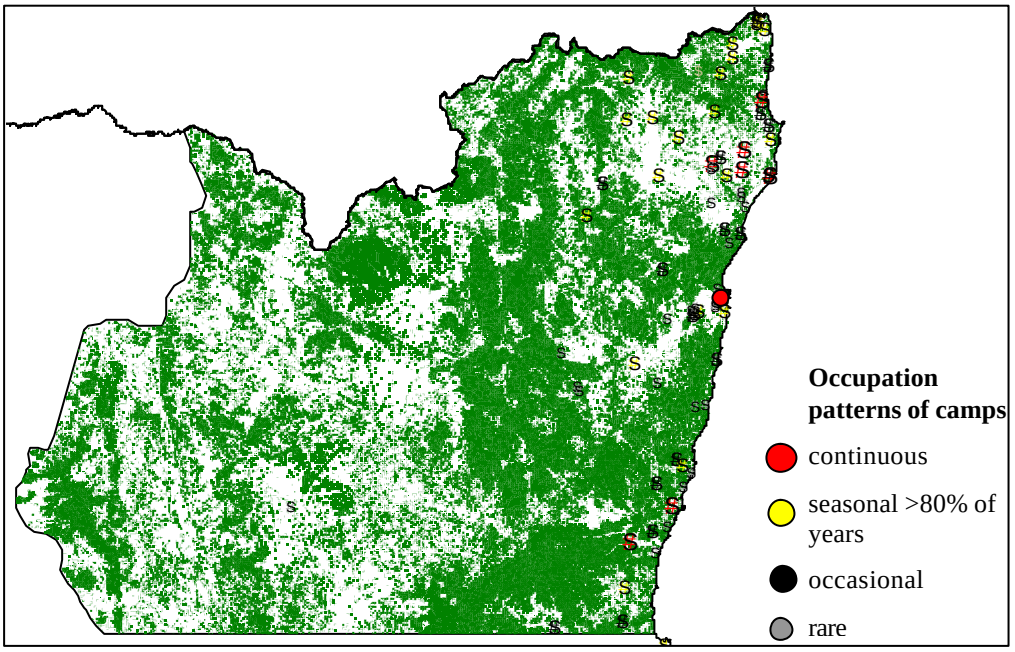
Climate in the region trends from sub-tropical on coastal lowlands with hot humid summers, mild winters and rainfall peaks in summer and autumn; to temperate on the tablelands and western slopes with drier conditions, warm summers, cold winters and no clear annual pattern of rainfall. Rainfall on the coastal lowlands varies from approximately 800 mm up to 1500 mm per annum, and generally decreases to the south and west. Rainfall west of the escarpment varies from approximately 500 to 800 mm per annum and generally decreases to the west. Rainfall trends throughout the region are moderated by topography.

Clearing for agriculture and development has removed continuous native vegetation from 46% of the land area of the region. Areas most heavily impacted occur on soils of moderate to high fertility on undulating land or alluvial plains. Steep land, particularly along the escarpment remain largely uncleared. Approximately 14% of the

land area in the region is held in conservation reserves and 8.6% forms part of the NSW State Forests estate. Several sites of Tertiary volcanic activity along the escarpment support exceptionally diverse rainforest vegetation and have been inscribed in the Australia Gondwana Rainforest World Heritage Area, including among others portions of the Border Ranges, Nightcap, Washpool, New England, Dorrigo and Oxley Wild River National Parks. Coastal areas of the UNE NSW region are under ongoing pressure from a rapidly increasing human population. Overall, the population of the NSW north coast is increasing at over 1% per annum and high rates of increase are projected to continue for the next 25 years (North Coast Area Health Service 2008). The population of the Tweed Shire is projected to rise by 81% in the 25 years from 1991 to 2116 (Tweed Shire Council 1999). Remnant vegetation on land suitable for development and agriculture continue to face significant impacts from clearing and degradation.

The locations of seventy-four camps used by Grey-headed flying foxes have been documented in the region (Figure 8.1.). The majority occur at altitudes below 200 m along the coastal lowlands and ranges. However, this pattern is likely to reflect bias in survey effort to some extent and further camp locations are likely to be documented in coming years, particularly camps in inland areas. A relatively high proportion of camps are occupied continuously. They are distributed in coastal areas across the length of the region. Seasonally occupied camps are widely distributed in coastal lowlands and ranges. These patterns of camp occupation reflect the significance of habitats in the region to Grey-headed flying foxes throughout the year.

Figure 8.1. The extent and distribution of remnant vegetation in the UNE NSW Region, showing the locations and patterns of use of known Grey-headed flying fox camps.



8.2. Grey-headed flying fox diet plants

8.2.1.Nectar diet

Forty species of plants in the nectar diet of Grey-headed flying foxes occur in the UNE NSW region (Table 8.1). The list contains 34 species in the Myrtaceae: two *Angophora*, five *Corymbia*, 25 *Eucalyptus* and one each of *Lophostemon*, *Melaleuca* and *Syncarpia*. There are three species in the Proteaceae, two *Banksia* and one *Grevillea*; and one species in the Fabaceae, *Castanospermum australe*.

These diet species are primarily found in sclerophyll forests and woodlands. However, there are two rainforest trees on the blossom diet of Grey-headed flying foxes, *Grevillea robusta* Silky Oak and *Castanospermum australe* Black Bean, and both are found in the UNE NSW region. These species generally occur in gallery or riverine rainforests, but are sometimes found in lowland subtropical rainforests on basalt soils (Floyd 1989).

8.2.1.1. Nectar scores and bi-monthly flowering schedules

Ten highly productive species (productivity scores $\geq$0.91) occur in the UNE NSW region: Spotted Gums *C. maculata* and *C. variegata*, Red Bloodwood *C. gummifera*, Pink Bloodwood *C. intermedia*, Blackbutt *E. pilularis*, Swamp Mahogany *E. robusta*, Grey Ironbark *E. siderophloia*, Forest Red Gum *E. tereticornis*, Five-veined Paperbark *M. quinquenervia* and Silky Oak *G. robusta.* A high proportion of these highly productive species also have regular flowering patterns, and 70% produce substantial resources in $\geq$60% of years (reliability score $\geq$0.60). The median weighted productivity x reliability score (wt p*r) for diet plants in the region is 0.56. Seventeen species (43%) score in the upper quartile of all diet plants in this project (wt p*r $\geq$0.65) and can be considered key diet plants for the region (Table 8.1.).

The rules set for determining bi-monthly phenologies in this project were relaxed for two species and subjective judgements were made (see Section 4.3.3.). Phenological data collated for *E. pilularis* were highly inconsistent. Flowering in this species is complex and erratic (see Florence 1964 and Law *et al.* 2000). We recorded the most commonly reported bi-monthly patterns (Table 8.2.). Nonetheless, we recognise that this species often flowers outside the bi-months assigned here. *E. campanulata* flowers in the October-November bi-month throughout its range. There are observations of September flowering in the UNE NSW region, however, the prevalence of September flowering could not be confirmed and the flowering schedule for this species was restricted to October-November. *E. campanulata* is a common and widespread species along the escarpment and edges of the tablelands. It is classified as a dominant in forests covering over 400,000 ha in the UNE NSW Region. Therefore, this judgement has significant implications for August-September assessments and further data should be acquired.

Diet plants in the region are productive in each bi-month, although species richness varies through the year (Table 8.2). Broad seasonal patterns in the number of productive species are in keeping with other regional areas. The greatest proportion flower in Dec/Jan (25 spp, 63%) and species richness reaches low levels from late autumn to early spring (6 spp, 15% in Apr/May). Variations in flowering phenologies within the region were recorded for three species, *E. piluaris, E. siderophloia* and *E. tereticornis*. Each of these species flowered earlier on coastal lowlands than inland and at higher altitudes.

Table 8.1. The nectar scores of diet plants found in the UNE NSW Region. Seventeen key diet species with weighted productivity * reliability scores ≥0.65 are highlighted in yellow. These are key species for Grey-headed flying foxes. The flowering characteristics of *E. pilularis* and *E. tereticornis* were found to vary under different conditions (see text) and two sets of scores are given for those species.

Species	Abundance	Synchrony	% yrs	Variation	Duration	Productivity	Reliability	Wt P*R
Angophora costata	0.3	0.7	0.4	0.7	0.33	0.37	0.30	0.35
A. floribunda	0.5	0.7	0.4	0.7	0.33	0.54	0.30	0.45
Banksia integrifolia	0.7	1	1	1	1.00	0.77	1.00	0.83
B. serrata	0.5	0.7	0.7	0.7	0.67	0.54	0.60	0.56
Corymbia gummifera	1	0.7	0.4	0.7	0.67	0.91	0.30	0.65
C. henryi	0.7	0.7	0.4	0.7	1.00	0.70	0.3	0.54
C. intermedia	1	1	0.7	0.7	0.67	1.00	0.60	0.86
C. maculata	1	0.7	0.4	0.7	1.00	0.91	0.30	0.65
C. trachyphloia	0.5	0.7	0.4	0.7	0.67	0.54	0.3	0.45
C. variegata	1	0.7	0.7	0.7	1.00	0.91	0.60	0.81
Eucalyptus acmenoides	0.3	0.7	0.7	0.7	0.33	0.37	0.60	0.43
E. albens	0.7	0.7	0.4	0.7	1.00	0.70	0.30	0.54
E. amplifolia	0.7	0.7	0.4	0.4	0.67	0.70	0.15	0.44
E. andrewsii	0.5	1	0.7	1	0.67	0.59	0.80	0.65
E. camaldulensis	0.7	0.7	0.7	0.7	0.33	0.70	0.60	0.67
E. campanulata	0.5	0.7	0.4	0.7	0.67	0.54	0.30	0.45
E. fibrosa	0.7	0.7	0.4	0.7	0.67	0.70	0.30	0.54
E. grandis	0.5	0.7	0.7	0.7	0.00	0.54	0.60	0.56
E. melanophloia	0.3	0.4	0.7	0.7	0.67	0.32	0.6	0.39
E. melliodora	0.7	0.7	0.4	0.7	0.67	0.70	0.30	0.54
E. moluccana	0.5	1	0.7	1	0.67	0.59	0.8	0.65
E. paniculata	0.7	0.4	0.4	0.7	1.00	0.61	0.30	0.49

Species	Abundance	Synchrony	% yrs	Variation	Duration	Productivity	Reliability	Wt P*R
E. pilularis	1	0.4	0.4	1	1.00	0.80	0.45	0.67
E. pilularis inland	1	0.7	0.4	1	1.00	0.91	0.45	0.74
E. pilularis poor	0.5	0.7	0.4	1	0.67	0.54	0.45	0.51
E. planchoniana	0.7	0.7	0.4	0.7	0.67	0.70	0.30	0.54
E. propinqua	0.5	0.4	0.4	0.4	0.67	0.47	0.15	0.34
E. punctata	0.50	0.70	0.70	0.70	0.33	0.54	0.60	0.56
E. pyrocarpa	0.7	0.7	0.4	0.7	0.67	0.70	0.30	0.54
E. resinifera	0.5	0.7	0.4	0.4	0.67	0.54	0.15	0.37
E. robusta	1	1	1	1	1.00	1.00	1.00	1.00
E. rummeryi	0.7	0.7	0.4	0.7	0.67	0.70	0.30	0.54
E. saligna	0.7	0.7	0.7	1	0.33	0.70	0.80	0.73
E. seeana	0.7	1	1	0.7	0.67	0.77	0.80	0.78
E. siderophloia	1	0.7	0.7	0.7	0.67	0.91	0.60	0.81
E. sideroxylon	0.7	0.7	0.4	0.7	1.00	0.70	0.30	0.54
E. tereticornis	1	0.7	1	0.7	0.67	0.91	0.80	0.88
E. tereticornis poor soils	0.50	0.70	0.40	0.40	0.67	0.54	0.15	0.37
Castanospermum australe	0.7	1	1	1	0.67	0.77	1.00	0.83
Grevillea robusta	1	1	1	1	0.33	1.00	1.00	1.00
Lophostemon confertus	0.3	1	1	0.7	0.33	0.41	0.80	0.50
Melaleuca quinquenervia	1	0.7	1	0.7	1.00	0.91	0.80	0.88
Syncarpia glomulifera	0.5	1	0.7	0.7	0.67	0.59	0.60	0.60

Table 8.2. Bi-monthly flowering schedules of diet plants found in the UNE NSW Region. The flowering schedules of three species vary within the region and these are indicated. See key below.

Species	Dec/Jan	Feb/Mar	Apr/May	Jun/Jul	Aug/Sep	Oct/Nov
Angophora costata	X					X
A. floribunda	X					
Banksia integrifolia			X	X	X	
B. serrata	X	X				
Corymbia gummifera	X	X				
C. henryi	X					X
C. intermedia	X	X				
C. maculata	X	X				
C. trachyphloia	X	X				
C. variegata	X	X				
Eucalyptus acmenoides						X
E. albens				X	X	
E. amplifolia	X					X
E. andrewsii	X	X				
E. blakelyi						
E. camaldulensis	X					
E. campanulata						X
E. crebra						
E. fibrosa	X	X				
E. grandis		X	X			
E. melanophloia	X					
E. melliodora	X					X
E. moluccana		X				
E. paniculata						
E. pilularis	B	B	A	A	A	
E. planchoniana	X					X
E. propinqua	X	X				
E. punctata	X	X				
E. pyrocarpa		X				
E. resinifera	X					
E. robusta			X	X		
E. rummeryi	X					X
E. saligna		X	X			
E. seeana					X	X
E. siderophloia	B				A	A,B
E. sideroxylon				X	X	X
E. tereticornis	D			A	A,C	C,D
Castanospermum australe	X					X
Grevillea robusta						X
Lophostemon confertus	X					
Melaleuca quinquenervia		X	X	X		
Syncarpia glomulifera					X	X
N species	25	16	6	7	8	15

A=coastal lowlands, B=foothills and ranges, C = inland low altitude, D = high altitude

8.2.2. Fruit diet

There are 46 species of trees and lianas in the fruit diet of Grey-headed flying foxes that occur in UNE NSW (Table 8.3). The floristic diversity of rainforest decreases to the south, and six of these species reach their southern limit within the region. The regional list comprises members of 26 families and 30 genera, with five genera represented by more than one species.

Table 8.3. Fruits in the diet of Grey-headed flying foxes that occur in the UNE NSW Region. Where the southern limit to a species occurs in the region the approximate latitude is given. The range of all other species extends beyond the southern boundary of the region.

Family	Species	Common name	Latitude of southern limit
GYMNOSPERMAE			
Podocarpaceae	*Podocarpus elatus*	Plum Pine	
ANGIOSPERMAE			
Anonaceae	*Rauwenhoffia leichardtii*	Zig Zag Vine	
Apocynaceae	*Melodinus australis*	Southern Melodinus	
Arecaceae	*Livistona australis*	Cabbage Palm	
	Archontophoenix cunninghamiana	Bangalow Palm	
Avicenniaceae	*Avicennia marina*	Grey Mangrove	
Cunoniaceae	*Schizomeria ovata*	Crabapple	
Davidsoniaceae	*Davidsonia* spp.	Davidson's Plum	28.8
Ebenaceae	*Diospyros pentamera*	Myrtle Ebony	
Ehretiaceae	*Ehretia acuminata*	Koda	
Elaeocarpaceae	*Elaeocarpus obovatus*	Hard Quandong	
	E. reticulatus	Blueberry Ash	
	E. grandis	Blue Fig	30.7
Escalloniacae	*Polyosma cunninghamii*	Featherwood	
Euphorbiaceae	*Mallotus discolor*	White Kamala	29.5
Icacinaceae	*Pennantia cunninghamii*	Brown Beech	
Meliaceae	*Melia azedarach*	White Cedar	
Monimiaceae	*Hedycarya angustifolia*	Native Mulberry	
Moraceae	*Ficus coronata*	Creek Sandpaper Fig	
	F. fraseri	Sandpaper Fig	
	F. macrophylla	Moreton Bay Fig	
	F. obliqua	Small-leaved Fig	
	F. rubiginosa	Rusty Fig	
	F. superba	Deciduous Fig	
	F. virens	White Fig	29.5
	F. watkinsiana	Strangler Fig	
	Maclura cochinchinensis	Cockspur Thorn	

Family	Species	Common name	Latitude of southern limit
Myrtaceae	*Acmena hemilampra*	Broad-lved Lilly Pilly	29.5
	A. ingens	Red Apple	28.8
	A. smithii	Lilly Pilly	
	Rhodamnia argentea	Malletwood	
	Syzygium australe	Brush Cherry	
	S. corynanthum	Sour Cherry	
	S. crebrinerve	Purple Cherry	
	S. luehmanii	Riberry	
	S. oleosum	Blue Lilly Pilly	
Passifloraceae	*Passiflora* sp.	Native Passionfruit sp.	
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	
Rhamnaceae	*Alphitonia excelsa*	Red Ash	
Rubiaceae	*Morinda jasminoides*	Morinda	
Sapindaceae	*Diploglottis australis*	Native Tamarind	
Sapotaceae	*Planchonella australis*	Black Apple	
Urticaceae	*Dendrocnide excelsa*	Giant Stinging Tree	
	D. photinophylla	Shining-lved Stinging Tree	
Viscaceae	*Notothixos cornifolius*	Kurrajong Mistletoe	
Vitidaceae	*Cissus hypogaluca*	Five-leaf Water Vine	

8.3. Vegetation classification and map

8.3.1. Description

The distribution and relative densities of diet plants in the UNE NSW region were described using a compilation map of the area that was produced to assist with managing habitat for threatened fauna ("Vegetation for Fauna" map, M. Andren, DECC (NSW)). The Vegetation for Fauna map was assembled from four primary sources (Figure 8.2.):

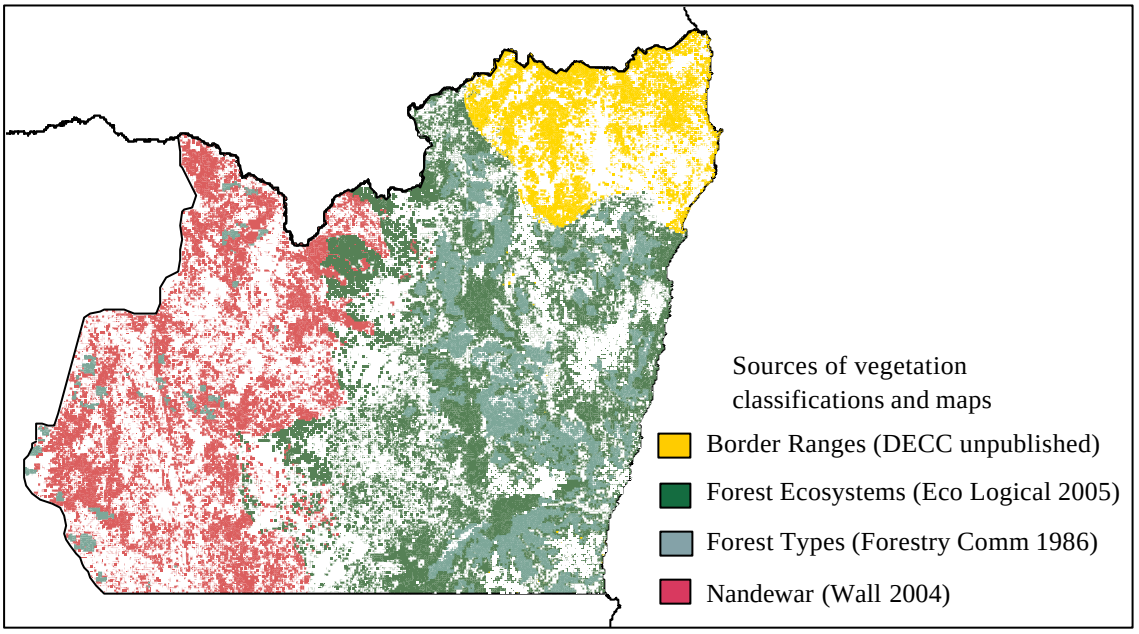
1. the revised Forest Ecosystem classification (Eco Logical 2005);
2. NSW State Forests Forest Types - primarily RN 17 types, but also Milli and some Lindsey Types (Forestry Commission of NSW 1989);
3. the Nandewar Western Regional Assessment project (Wall 2004); and
4. the Border Ranges map (A. Steed, DECC (NSW) unpublished).

Vegetation mapping in north eastern NSW has a complex history. Two independent projects classified and mapped vegetation north from the Hunter River for the Comprehensive Regional Assessment (CRA) in the late 1990s. The CRAFTI product was based on aerial photograph interpretation (NPWS 1998) and the Forest Ecosystem product was based on modelled vegetation types (NPWS 1999). Vegetation in the state forest estate was mapped for the CRA using the RN 17 Forest Type classification (Forestry Commission of NSW 1989).

In 2005, a revised vegetation classification and map was produced for the Northern Rivers CMA in which line work from an updated CRAFTI product (NPWS 2001) was integrated with a revised Forest Ecosystem classification (Eco Logical 2005). A number of local maps, generally produced by local governments, were incorporated and these fine scale datasets were given priority. The original Forest Ecosystem classification focused on publicly owned land, particularly commercial forest types. Although the revised classification extended the work onto privately owned land and non-commercial vegetation, it was considered uneven and overly broad in these areas (Eco Logical 2005). The Border Ranges map, in the north east of the region, was developed to improve the accuracy of rainforest classifications in the area (A. Steed, DECC (NSW) pers. comms.). Using the Forest Ecosystem map as its base, it reassigned vegetation types to line work using RN 17 Forest Types for rainforest types and Qld Regional Ecosystems v.5. elsewhere (Sattler and Williams 1999, Accad *et al.* 2006).

Of the four source products, only the Nandewar classification provided numeric descriptions of vegetation types suitable for estimating densities of diet species using the frequency-cover abundance method. All others produced descriptive lists of dominant and sub-dominant species and the averaging method was used to estimate the relative densities of nectar diet species in those vegetation types. The scale of mapping in the UNE NSW region was generally 1:100 000, although substantial areas in coastal zones were mapped at 1:25,000. In total, 882 vegetation types were described in the UNE NSW classification and map.

Figure 8.2. The extent and distribution of vegetation classifications and maps that were compiled to create the UNE NSW regional map.



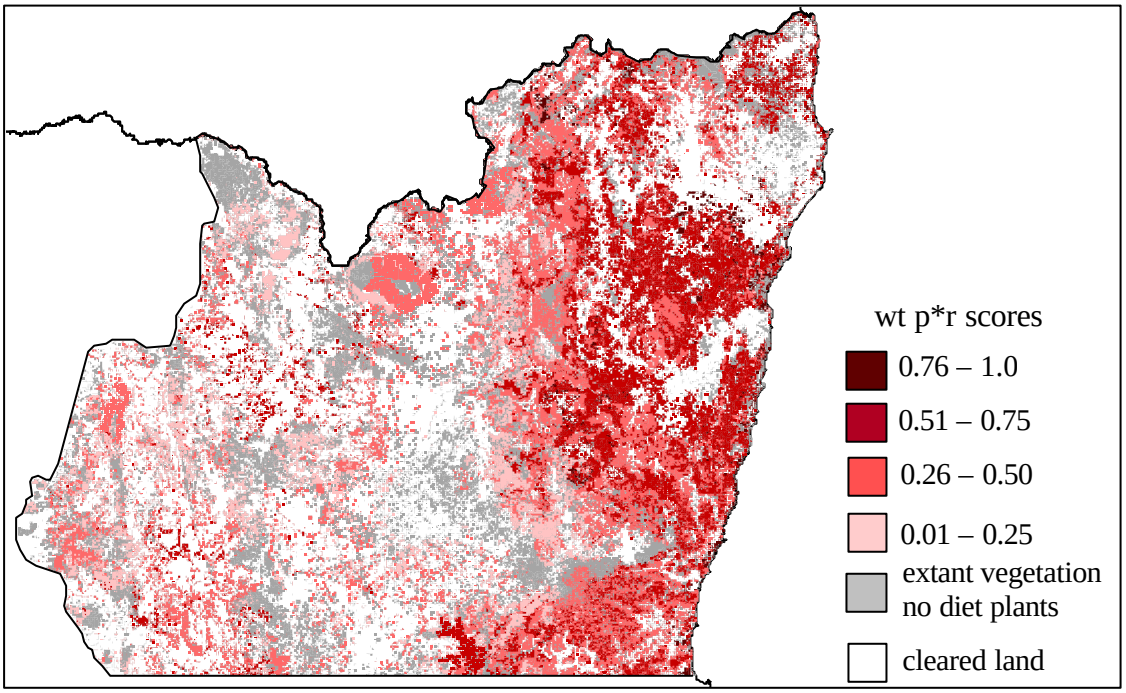
8.3.2. Habitat scores - nectar

Of the 882 vegetation types identified in the UNE NSW region, 457 (52%) contain plants in the nectar diet of Grey-headed flying foxes. Forests and woodlands that potentially produce nectar for the animals cover 35% of the region, or approximately 65% of extant vegetation (Figure 8.3). These vegetation types are widely distributed in the region, and are found on coastal lowlands, hills, coastal ranges and western slopes. Few vegetation types that produce nectar for Grey-headed flying foxes are found at altitudes >800 m or on the plateaux of the tablelands.

Scores for total nectar productivity, reliability and wt p*r were calculated for each vegetation type (Appendix 2.). These total habitat scores do not take seasonal variations into account and so are of limited assistance in assessing the significance of vegetation types for Grey-headed flying foxes. However, they provide a means of summarising patterns of overall habitat quality within the region. Wt p*r scores are of greatest interest as they combine productivity and reliability scores into a single value. Vegetation types having wt p*r scores >0.75 are rare in the UNE NSW region, making up 3% of vegetation types (n=26) and 0.7% of the land area. They primarily comprise small remnants of forest on coastal floodplains and dominated by *Melaleuca quinquenervia, Eucalyptus robusta* and *E. tereticornis.* Wet and dry schlerophyll forests dominated by Spotted Gum *C. variegata* are also included.

Overall habitat quality in the UNE NSW region is high and 14% of the land area in the region supports forests and woodlands with total wt p*r scores >0.50. These vegetation types are primarily found east of the escarpment at altitudes of <300 m. Diet plants that feature in these types include the species listed above and *B. integrifolia, C. intermedia, C. henryi, E. grandis, E. moluccana, E. saligna, E. siderophloia* and *Syncarpia glomulifera.*

Figure 8.2. Map of the UNE NSW region showing the extent of remnant vegetation and cleared land. Vegetation types that contain plants in the nectar diet of Grey-headed flying foxes are depicted in graduated colours of red which indicate increasing wt p*r scores. Seasonal variations are not taken into account. Polygons containing high-scoring vegetation (wt p*r = 0.76 – 1.0) are small and rare. Those that are clustered along the coastal strip are generally not discernible at the scale of this map.



8.3.2.1. Bi-monthly nectar scores

When habitat nectar scores are calculated including only the species that flower in each bi-monthly interval, distinctive patterns become apparent in the extent, distribution and nectar characteristics of productive habitat (Table 8.4, Figures 8.3. and 8.4.).

UNE NSW is a productive region for Grey-headed flying foxes during the warmer months (Table 8.4, Figure 8.4). Area-weighted indices for the region are high from October-November to February-March. The area of productive habitat is consistently high through this period, although the overall quality of vegetation types as measured by mean wt p*r scores is low in late spring and summer (Figure 8.3). A distinct change in habitat characteristics occurs between the February-March and April-May bi-months. The area of productive land in UNE NSW is notably low from April to July, being approximately 20-23% of the values from October-November to December-January. Indices of regional productivity are low despite high mean wt p*r values for productive vegetation types. All productive habitat is located east of the escarpment in April-May. Vegetation types with wt p*r values >0.75 are dominated by *M. quinquenervia* or *E. robusta* and occur as small remnant patches in coastal areas. In June-July, the distribution of productive habitat is divided between floodplain or heath vegetation on coastal lowlands, and box woodlands in the far west of the region (Figure 8.4.). Mean wt p*r scores for these vegetation types are significantly higher than those that are productive from August-September to February – March (Figure 8.3.). However, the elevated habitat quality does not compensate for the restricted productive area and area-weighted indices are low.

Vegetation on coastal floodplains in NSW has been substantially cleared and the forest types in these areas that produce high quality habitat for Grey-headed flying foxes from April to July are recognised as Endangered Ecological Communities (EECs) under the NSW Threatened Species Conservation Act (NSW Scientific Committee 2004 a, b and c; Keith and Scott 2005). Equally, box woodlands west of the escarpment that produce high quality habitat in winter are also heavily cleared and listed as EECs (NSW Scientific Committee 2002). These vegetation types remain under pressure from agriculture and urban development, creating a significant conservation issue for Grey-headed flying foxes (NSW Scientific Committee 2001, Eby and Lunney 2002, Law *et al.* 2002).

Table 8.4. Features of habitat productive for Grey-headed flying foxes in the UNE NSW region in each bi-month.

	Dec-Jan	**Feb-Mar**	**Apr-May**	**Jun-Jul**	**Aug-Sep**	**Oct-Nov**
n vegetation types	335	254	116	125	204	225
productive area (ha)	1,863,081	1,477,358	396,122	400,557	1,002,913	1,736,217
% regional land area	25.7%	20.4%	5.5%	5.5%	13.8%	24.0%
area-weighted index	0.09	0.06	0.02	0.02	0.04	0.07

Figure 8.3. Mean (±1 s.e.) bi-monthly weighted productivity x reliability scores for vegetation types in the UNE NSW region. Differences between bi-months are significant (GLM; $p<0.0001$)

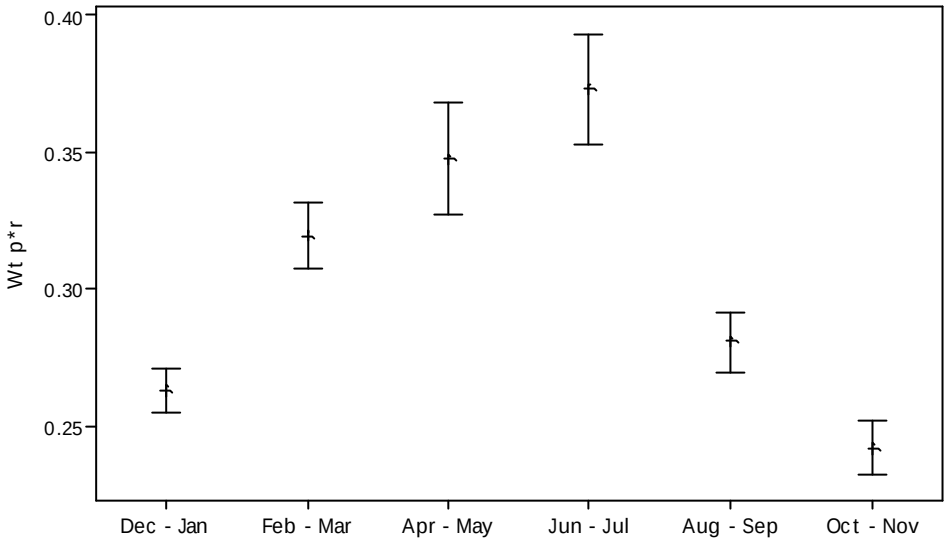
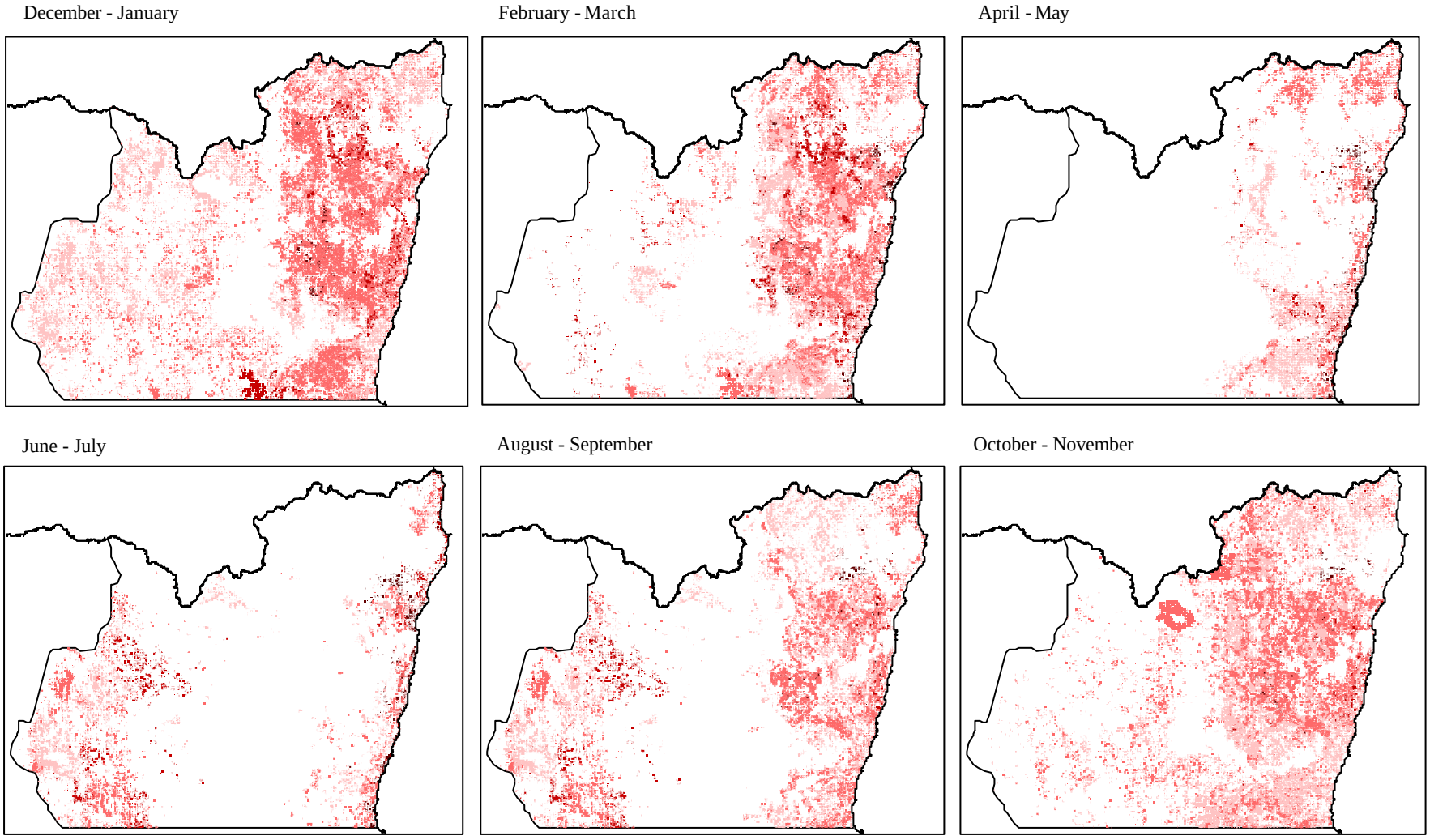


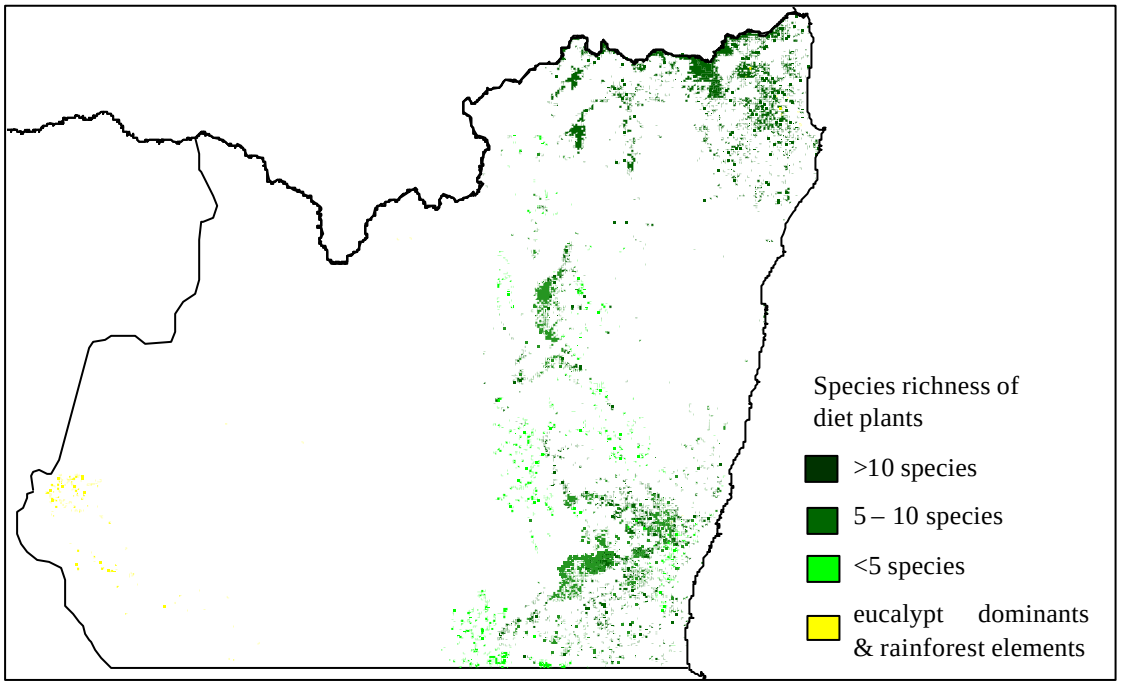
Figure 8.4. Maps of the UNE NSW region showing the wt p*r scores of vegetation types calculated at bi-monthly intervals. Graduated colours indicate increasing values. For key see Figure 8.2.



8.3.3. Habitat scores - Fruit

Structurally complex and floristically diverse subtropical rainforests are found in the UNE NSW region, particularly on extensive xxx of volcanic soils in the north (Figure 8.5.). Less diverse warm temperate, cool temperate and littoral rainforests are also found in the region (Floyd 1989). Various layered wet sclerophyll vegetation types contain substantial rainforest elements in the sub-canopy. All but cool temperate rainforest contain trees and vines in the fruit diet of Grey-headed flying foxes. Plants in the fruit diet of Grey-headed flying foxes are found in 58 vegetation types in the UNE NSW region. These vegetation types comprise 2.6% of the land area in the region (Figure 8.5.). 46 of the vegetation types are classified as rainforest vegetation and 12 are layered wet sclerophyll types that are dominated by eucalypts but contain a sub-canopy with substantial rainforest elements. The species richness of diet plants in these vegetations varies considerably. In general, complex subtropical rainforest has the most floristically diverse canopy and the greatest species richness of fruit diet plants. These types are found on rich volcanic and alluvial soils, in sheltered, moist positions (Floyd 1989). Dry rainforest) is less diverse, less complex and contains fewer diet plants. These types are found in drier conditions than subtropical rainforest. Warm temperate rainforest and littoral rainforest also contain diet plants, but in fewer number. More than 10 diet plants are found in 32 vegetation types, 6 types contain 5-10 and 8 contain <5.

Figure 8.6. The distribution in the UNE NSW region of rainforest vegetation containing plants in the fruit diet of Grey-headed flying foxes. Graduated colours indicate the species richness of diet plants, with deeper colours assigned to more diverse types.



8.4. Habitat ranks

8.4.1. Bi-monthly ranks

Table 8.5. Thresholds of weighted productivity x reliability scores used to set bi-monthly habitat ranks. These thresholds assign approximately equal areas of vegetation to each rank in each bi-month.

	Dec-Jan	Feb-Mar	Apr-May	Jun-Jul	Aug-Sep	Oct-Nov
RANK 1	0.44 - 0.81	0.38 - 0.88	0.43 - 1.0	0.42 - 1.0	0.33 - 0.88	0.32 - 0.88
RANK 2	0.32 - 0.43	0.28 - 0.37	0.27 - 0.42	0.29 - 0.39	0.27 - 0.32	0.27 - 0.31
RANK 3	0.18 - 0.31	0.19 - 0.27	0.20 - 0.26	0.22 - 0.28	0.20 - 0.25	0.15 - 0.26
RANK 4	0.03 - 0.17	0.04 - 0.18	0 04 - 0.19	0.06 - 0.21	0.03 - 0.19	0.01 - 0.14

8.4.2. Final habitat ranks

The highest bi-monthly rank for each of the nectar-producing RE types was taken as the final nectar rank for that type. In addition, each rainforest type that contained >5 plants in the diet of Grey-headed flying foxes was assigned a rank of 1. Those containing <5 were assigned ranks of 2. This procedure increased the area of habitat allocated to rank 1 and rank 2 (Table 8.6.). Overall, vegetation covering 16% of the region was allocated rank of 1 and 9% rank of 2. This represents 33.5% and 16.7% of extant vegetation respectively. Lists of each RE type in the SEQ region and its final rank are provided in Appendix 2.

Table 8.6. The extent and diversity of the vegetation types assigned to each rank.

	area (ha)	% region	n (veg types)
RANK 1	1,307,000	18.0%	240
RANK 2	650,000	9.0%	104
1RANK 3	471,000	6.5%	87
RANK 4	294,000	4.1%	70

Figure 8.8. The bi-monthly distributions of RE types in the UNE NSW region ranked according to their significance as feeding habitat for Grey-headed flying foxes Rank 1 Rank 2 Rank 3 Rank 4

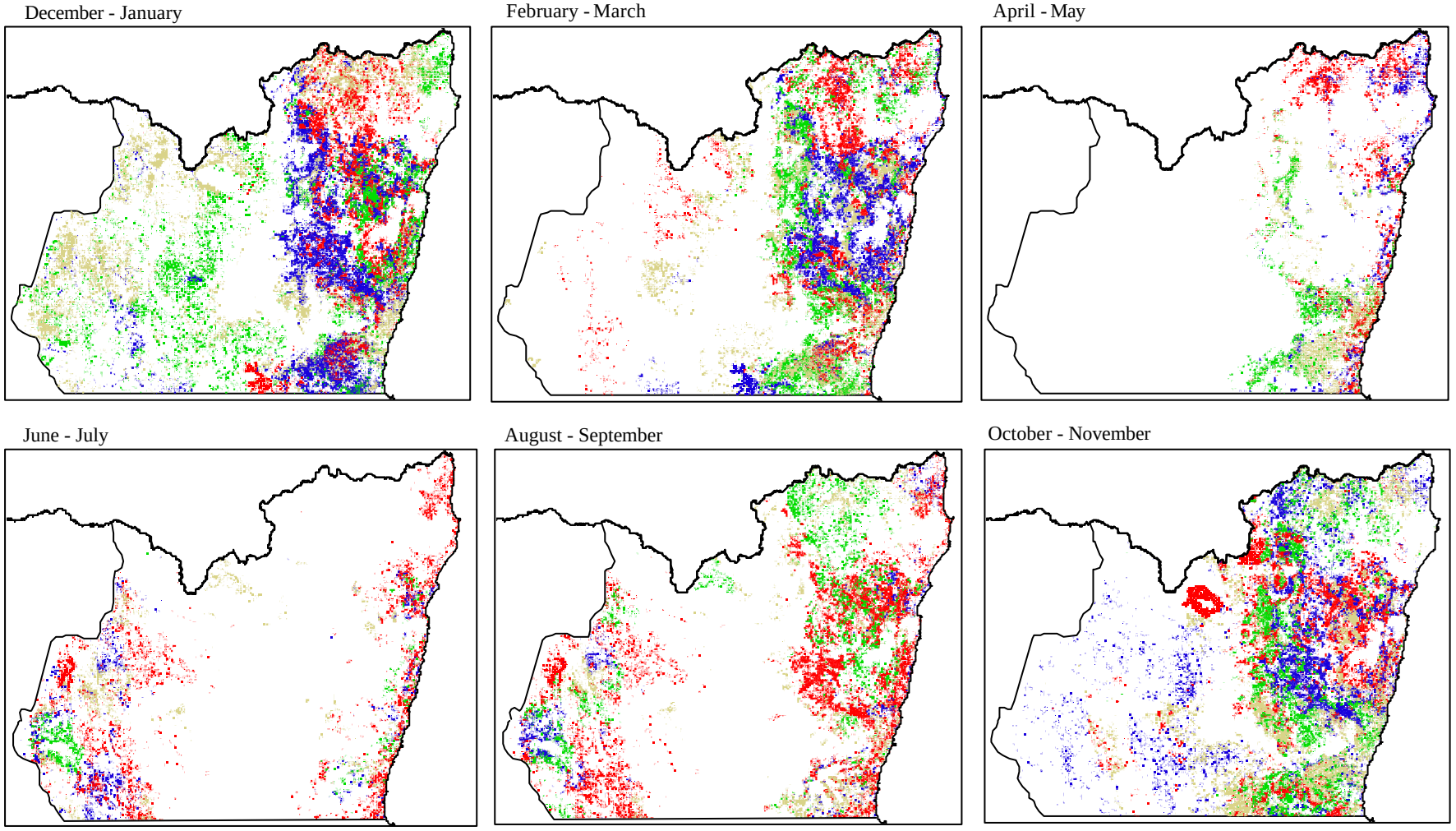


Figure 8.7. A map of the UNE NSW Region showing the final ranks of feeding habitat for Grey-headed flying foxes.