

The Murray Darling Basin

The Murray Darling Basin (MDB) covers a total area of 1,061,469 km² and consists of 19 major catchments (Figure 1).



Figure 1. The Murray Darling Basin catchment boundaries.
Source: MDBC Natural Resources website

To put the issue of the spread of Lippia into perspective it is important to recognise both the ecological and economical value of the resources of the Murray Darling Basin to the well being of Australia as a whole. The following information was sourced from the MBDC natural resources website.

The Basin extends over three-quarters of New South Wales, more than half of Victoria, significant portions of Queensland and South Australia, and includes the whole of the Australian Capital Territory. Over half of the Basin is in New South Wales and almost a quarter is in Queensland

- The Darling (2740km), Murray (2530km) and Murrumbidgee (1690km) are Australia's three longest rivers.
- At the 1996 Census, the Basin had an estimated population of 1,956,765 almost 11% of the total Australian population.

- At the time of European settlement the range of species in the Basin included 85 mammals, 367 birds, 151 reptiles, 24 frogs and 20 freshwater fish.
- The Basin has at least 35 endangered birds and 16 endangered mammals with 20 mammals being extinct.
- There are 3 Wetlands of International Importance (Ramsar sites) within in the Basin.
- It is estimated that there are more than 30,000 wetlands in the Basin. The total area of crops and pastures irrigated in the Basin is 1,472,241 hectares. This is 71.1% of the total area of irrigated crops and pastures in Australia (2,069,344 ha). Note: these figures are based on 1992 estimates.
- Around 70% of all water used for agriculture in Australia is used by irrigation in the Basin (1992).
- The Basin is Australia's most important agricultural region, accounting for 41 per cent of the nation's gross value of agricultural production (1992).
- Manufacturing industries in the Basin have a turnover of more than \$10.75 billion (1992).

Lippia occurs predominantly on the clay soil floodplains of the inland river system in the 500-800mm annual rainfall zone of Queensland and NSW, although it is present throughout the entire Murray Darling Basin. The worst affected catchments are the Condamine, Border Rivers, Gwydir, Namoi, Lachlan, Murrumbidgee and the Murray.



Plate 1

Lippia growing on the banks of the Murrumbidgee River at the Maude Weir west of Hay, NSW.

Distribution of Lippia throughout the Murray Darling Basin

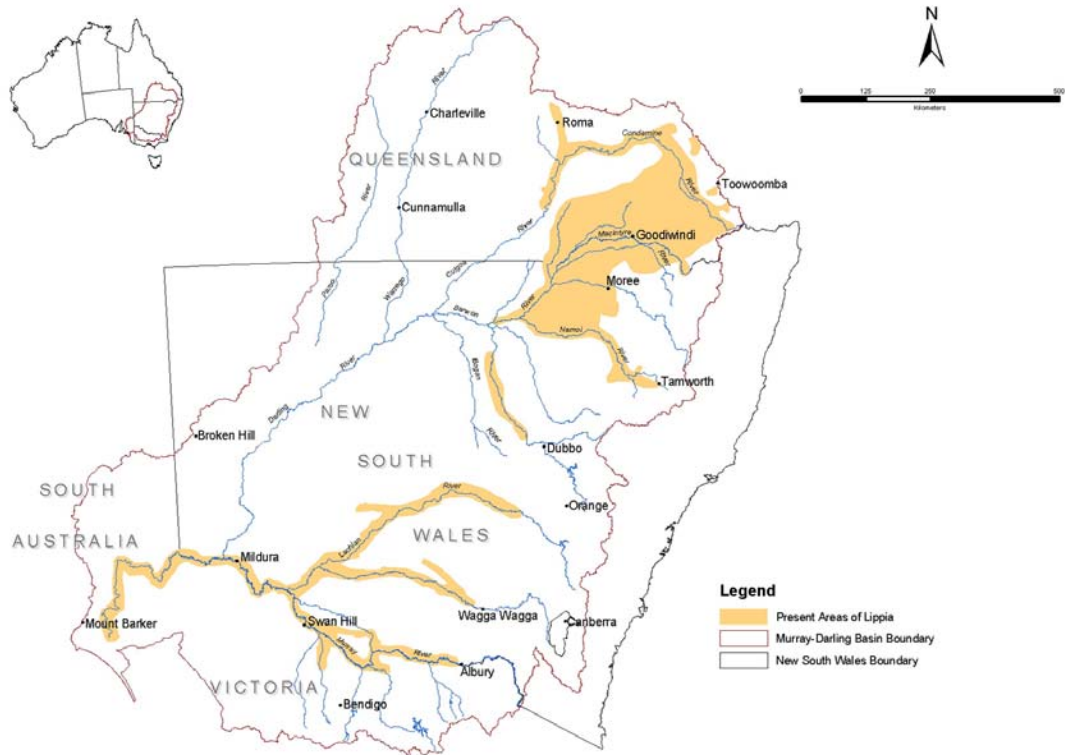
Lippia is currently estimated to be distributed across at least 5% of the Murray Darling Basin (MDB) covering a total area in the order of 5.3 million hectares, the distribution of Lippia throughout the MDB is illustrated in Figure 2. Of this area an estimated 50% is cultivated which effectively suppresses the appearance and impact of Lippia in these areas. The recent estimate represents a significant increase on the previous estimation reported by McCosker (1994a) presented in Figure 3. The extent of the increase in the distribution of Lippia across the MDB is supported by most stakeholders interviewed during the course of the study.

Lippia occurs in varying density in each of the 19 catchments of the Murray Darling Basin. Table 1 lists the catchments and notes whether it is generally recognised as a problem.

Table 1. The 19 catchments of the Murray Darling Basin. The occurrence of Lippia (*Phyla canescens*) and indication of its recognition as a problem species.

Catchments	Lippia present	Recognised Problem
<u>Queensland</u> Area within the MDB 260,011 km ²		
Border Rivers *	✓	✓
Condamine *	✓	✓
Maranoa-Balonne	✓	✓
Warrego-Paroo	✓	✗
<u>New South Wales</u> Area within the MDB 602,240 km ²		
Border Rivers *	✓	✓
Central West	✓	✓
Gwydir *	✓	✓
Lachlan *	✓	✓
Lower Murray Darling	✓	✗
Murray *	✓	✓
Murrumbidgee *	✓	✓
Namoi *	✓	✓
Western	✓	✗
<u>Victoria</u> Area within the MDB 130,474 km ²		
Goulburn-Broken	✓	✓
Mallee	✓	✓
North Central	✓	✓
North East	✓	✓
Wimmera	✓	✗
<u>South Australia</u> Area within the MDB 68,744 km ²		
SA Murray-Darling Basin	✓	✗
Key: *		worst affected areas
✓		yes
✗		not widely

Figure 2. The current estimated distribution of lippia in MDB.



The north-east section of the Murray Darling Basin represents the largest continuous land area affected by the presence of Lippia and covers parts of the Condamine, Border Rivers and Gwydir catchments. Twenty two mapsheets of the region were able to be sourced and indication of areas where Lippia was known to occur was provided by stakeholders. The total area of the region covered by the mapsheets was 5.676 million hectares (Figure 4). Of this area it was estimated that Lippia occurs over 2.567 million hectares or 45% of the total area.

The level of cover provided by Lippia was not considered in this estimation and density of ground cover varied from <1 to 100%. The impact of the severe drought affecting most inland areas had also restricted the growth of Lippia. In many situations where Lippia cover was below 10% at the time of the study, it was anticipated that with the return of favourable soil moisture conditions and the absence of other species the level of cover afforded by Lippia would increase significantly within a short period of time.

Calculation of estimated distribution of Lippia

The estimate of the area over which Lippia occurs throughout the MDB was calculated on the basis of information gathered throughout the consultation process. Data used for the calculation were sourced using the following methods:

- Where topographic maps were available stakeholders were asked to indicate the areas affected by Lippia on these maps.
- Where no maps were available stakeholders advised of the areas affected in general terms without specifically marking the boundaries of these areas.
- Shire Council personnel were asked to nominate the area of their respective shires they estimated to be affected by Lippia.
- Landholders were asked to evaluate the areas of their property affected.
- National Parks & Wildlife Service staff were asked to nominate areas they knew to be affected by Lippia within conservation areas.
- NSW Agriculture and DIPNR staff were asked to nominate areas they knew to be affected by Lippia within their respective regions or areas that had been recently surveyed as part of regional mapping projects.
- In other areas, e.g. along the Murrumbidgee River, Lippia was observed to be present along the river banks at every site inspected from Hay to Balranald. In such cases the average distance of Lippia occurrence from the river bank was multiplied by the length of river travelled to estimate the total area affected.

From the information gathered from each source and accounting for potential overlaps in the areas, the cumulative total area where Lippia was known to occur was calculated.

				Millmeran 136,000 ha	Toowoomba 148,000 ha	
		Goodar 132,000 ha	Wyaga 6,500 ha	Inglewood 65,100 ha	Allora 244,000 ha	Warwick 198,000 ha
Gradule 132,000 ha	Boomi 132,000 ha	Goondiwindi 264,000 ha	Yetman 27,300 ha	Texas	Stanthorpe	
Caloona 132,000 ha	Dolgelly 132,000 ha					
Weemalah 132,000 ha	Garah 105,600 ha	Croppa Ck 132,000 ha	Rocky Ck	Ashford	Clive	
Goonal 132,000 ha	Moree 118,800 ha	Pallamalawa 66,000 ha	Graman			
Telleraga 132,000 ha	Gurley 66,000 ha	Gravesend 39,600 ha				
		Bellata 33,000 ha	Terry Hie Hie 19,800 ha			

Figure 4. Schematic diagram of Topographical mapsheets of the north-eastern portion of the MDB and land areas over which Lippia is distributed. This region represents the area most severely impacted by the presence of Lippia. Large blocks represent 1:100,000 mapsheets (approximately = 264,000 ha) and smaller blocks represent 1:50,000 mapsheets (approximately = 132,000 ha). Lippia was not reported as present in shaded areas.

Distribution of Lippia in sub-catchments within the MDB

Condamine

Lippia is present in each of the sub-catchments of the Condamine River (Table 2). Lippia was initially recognised as a potential problem in the Condamine catchment in 1953 (Lucy *et al.* 1995). A survey of the catchment by Mann in 1960 indicated 40,000 hectares of the Upper Condamine was affected by Lippia. A subsequent survey conducted by Csurhes in 1989 indicated Lippia was present over 60,000 hectares and a landholder survey by Powell in 1992 indicated 80,000 hectares were affected by Lippia (Lucy *et al.* 1995). It is estimated that Lippia currently occurs over 1 million ha of the total estimated 2.5 million hectare area of the Condamine catchment. The rate of increase of Lippia in the Condamine is illustrated in Figure 5.

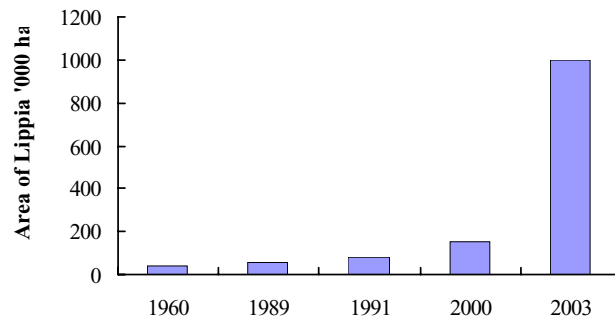


Figure 5. Estimated distribution of Lippia throughout the Condamine catchment over time.

In many sub-catchments of the Condamine, Lippia is reportedly suppressed by continual cultivation (Table 2). In such areas, while Lippia does not limit the crop productivity to any significant extent, but in the absence of cultivation, Lippia would likely dominate these areas within 1-2 years of cessation of the disturbance and as such can be considered present. These cultivated paddocks would likely have Lippia present in the seed bank and those situated on flood prone areas are highly vulnerable to importation of Lippia following any period of inundation.

Lippia is present at high densities throughout the Condamine from Warwick, north to Toowoomba and Dalby, west through Millmerran, Tara and as far north as Chinchilla.

A meeting of landholders in the catchment suggested that soil conservation work, the establishment of contour banks and narrow channels altered the movement of water across the landscape and the velocity of flow which is thought to have accelerated the spread of Lippia to catchments further south. Development associated with irrigation has also had the effect of altering the hydrology of the region.

Table 2. The occurrence of *Lippia* (*Phyla canescens*) in sub-catchments of the Condamine catchment of Queensland and indication of its recognition as a problem species.

Sub-Catchments	Lippia present	Recognised problem
Southern Creeks	✓	✗
Six Mile & Thanos Creek	✓	✗
Condamine River	✓	✓
South West Creeks	✓	✗
Ashall Creek	✓	✓
Hodgson Creek	✓	✗
Kings Creek	✓	✓
Dalrymple Creek	✓	SC
Glengallan Creek	✓	SC
Swan and Emu Creek	✓	✓
Condamine River upstream	✓	✓
Myall Creek	✓	SC
Oakey Creek	✓	SC
Lower Condamine	✓	✗
Charley's Creek	✓	✗

Key: ✓ yes
 ✗ not known
 SC suppressed by cultivation

Many farmers and agency personnel reported the increasing occurrence of *Lippia* in hilly areas, well above flood water reaches and onto lighter soils to the south-west. In a survey conducted on the Darling Downs in 1996 Fensham (1998) did not record *Lippia* as present within 83 hill woodland sites. This would suggest the encroachment of *Lippia* into these areas has occurred to a large extent in the last five years.

Border Rivers NSW

Lippia occurs in all western sub-catchments of the NSW Border Rivers catchment (Table 3). There are significant problems associated with the presence of very high densities of *Lippia* in the Croppa Creek, Whalan Creek, Gil Gil Creek and Gundablui sub-catchments. These areas include some of the most severely affected areas in the MDB. Production losses in areas of this catchment have been significant, a number of landholders indicating that they had totally destocked as a result of *Lippia* invasion.

The presence of *Lippia* within the Inverell sub-catchment is restricted to lawns, parks and small patches along waterways. Many of the waterways and roadsides of the Yetman, Ottley's Creek and Dumaresq sub-catchments have dense *Lippia* populations present and the incidence of *Lippia* on floodplain pastures has reportedly increased markedly since the floods of 1998.

In Queensland, *Lippia* is widespread around Goondiwindi, Inglewood, Wyaga and to a lesser extent around the Toobeah and Minnel Creek areas. Throughout the combined Queensland and New South Wales, Border Rivers catchments *Lippia* is estimated to be present in varying density across 1.16 million hectares.

Table 3. The occurrence of *Lippia* (*Phyla canescens*) in sub-catchments of the Border Rivers catchment of NSW and an indication of its recognition as a problem species.

Sub Catchment	<i>Lippia</i> present	Recognised Problem
Tenterfield	✓	✗
Mole River	✗	N/a
Reedy Creek	✗	N/a
Beardy Creek	✗	N/a
Kings Plain	✗	N/a
Bonshaw	✗	N/a
Camp Creek	✗	N/a
Stony Creek	✗	N/a
Inverell	✓	✗
Yetman	✓	✓
Ottley's Creek	✓	✓
Dumaresq	✓	✓
Croppa Creek	✓	✓
Gil Gil Creek	✓	✓
Whalan Creek	✓	✓
Gundablui	✓	✓

Key: ✓ yes
 ✗ not known
 N/a not applicable

Gwydir

Lippia has been recognised as present in the lower Gwydir for over 50 years. The Gwydir wetlands, Gingham and Big Leather watercourses, comprised 220,000 ha prior to river regulation (Bennett & Green, 1993), both are listed under the Ramsar Convention as Wetlands of International significance. The water regime responsible for sustaining these wetlands changed significantly with the construction of Copeton Dam and the development of more extensive irrigation in the lower Gwydir Valley. (Mawhinney, 2002).

In response to the changed water regime many farmers have adapted their practices and large areas of land have been cleared for cultivation (McCosker 1994b). There has also been a significant decline in the perennial grass component in most pastures within the catchment and *Lippia* now dominates along with annual grasses and forbs. The altered water regime likely weakened the native perennial grasses which were well adapted to frequent inundation by floodwaters. The additional stress of frequent defoliation associated with low density livestock grazing.

Table 4. The occurrence of *Lippia* (*Phyla canescens*) in sub-catchments of the Gwydir catchment of NSW and an indication of its recognition as a problem species.

Sub Catchment	<i>Lippia</i> present	Recognised Problem
Copeton Dam	✘	N/a
Moredun Creek	✘	N/a
Georges Creek	✘	N/a
Laura Creek	✘	N/a
Bakers Creek	✘	N/a
Booralong Creek	✓	✘
Upper Gwydir River	✘	N/a
Rocky River	✘	N/a
Keera	✓	✘
Warialda Creek	✓	✓
Myall Creek	✓	✘
Halls Creek	✓	✘
Lower Horton	✓	✘
Rocky Creek	✓	✘
Upper Horton	✓	✘
Mosquito Creek	✓	✓
Slaughterhouse	✓	✓
Upper Tycannah	✓	✓
Gurley Creek	✓	✓
Boggy Creek	✓	✓
Milli Creek	✓	✓
Gingham Watercourse	✓	✓
Gwydir	✓	✓
Mehi River	✓	✓
Barwon River	✓	✓
Thalabah Creek	✓	✓

Key: ✓ yes
 ✘ not known
 n/a not applicable

The presence of *Lippia* in the Booralong sub-catchment (west of Armidale) is currently limited to a small patch on a single property. It is thought to have been carried to the site attached to motor vehicles. The property owner also has a holding of land in the western area of the catchment.

A survey conducted by McCosker in 1992 recorded Lippia's presence at 75 of 150 sites, at 47 of these sites Lippia provided 25% or more of the total ground cover (Lucy *et al.* 1995). Based on these results the author estimated 80,000 ha of the Gwydir catchment to be moderately to severely affected by Lippia. Currently Lippia is estimated to be present over 8,450 ha of the Gwydir catchment.

A selection of these sites have been resurveyed on a number of occasions since that time (Table 5). Data provided by Rob McCosker shows the variation in Lippia cover over time at these sites.

Table 5. Changes in percentage cover of Lippia at 5 sites within the Gwydir Catchment.

	Nov 92	Feb 95	Feb 96	Jun 96	Oct 96	Apr 97	Aug 97	Nov 97	Mar 98	Nov 98	Apr 03
Site 1	0	0	0	0	0	0	0	0	0	0	35
Site 2	9	15	1	5	5	10	0	26	11	19	24
Site 3	1	2	11	43	51	11	5	73	75	60	26
Site 4	37	35	20	52	68	43	71	76	41	99	29
Site 5	0	0	0	0	0	0	0	0	0	5	29

Source: McCosker unpublished data

Namoi

Detailed information on the presence of Lippia in each of the respective sub-catchments of the Namoi was not able to be sourced, however, in those sub-catchments where Lippia was known to occur it was often present at very high density and recognised as a serious problem (Table 6).

Lippia occurs commonly in lawns, parks and gardens throughout the Namoi catchment, having been planted as a lawn substitute many years ago. It is present in the streets of Tamworth, Gunnedah, Quirindi Barraba, Manilla, Boggabri, Narrabri and Wee Waa. Lippia is also common along roadsides and within reserves throughout the Shire Council areas within the catchment.

There is apparently no detailed survey data available as to the distribution of Lippia along the Namoi River or its tributaries. It was first observed in the Boggabri area in the early 1990s and it was thought to be introduced to the area following flooding which originated from Cox's Creek. Lippia is reported to be widespread along Cox's Creek from Mullaley.

West of Narrabri Lippia was first observed in the mid 90's and following the 1998 flood it became a significant issue with 10 – 20% cover of Lippia present across a wide area of the floodplain. Following the 2000 flood Lippia cover was estimated to increase to 50% and currently Lippia covers 70% of the grazing land which has been subject to inundation.

Along the Namoi River and Gunidgera Creek west of Wee Waa it was first observed following the 1998 flood. Currently there is 400 ha of land adjacent to the Gunidgera Creek heavily infested with Lippia and it is reported to be increasing in density in lighter soils away from the creek. It is also present over large areas at Burren Junction and is common as far west as Walgett.

Table 6. The occurrence of *Lippia* (*Phyla canescens*) in sub-catchments of the Namoi catchment of NSW and an indication of it's recognition as a problem species.

Sub Catchment	Lippia present	Recognised Problem
Mid MacDonald	✓	✗
Upper McDonald	✗	N/a
Cockburn River	NS	N/a
Upper Peel River	✗	N/a
Chaffey	✗	N/a
Quirindi	✓	✓
Warrah	✗	N/a
Upper Namoi	✓	✓
Lower Peel	✓	✓
Werris Creek	✓	✓
Phillips	✗	N/a
Upper Manilla	✓	✓
Lower Manilla	✓	✓
Rangira	✓	✓
Keepit	✓	✓
Carroll	✓	✓
Mooki	✓	✓
Lake Goran	✓	✓
Bundella Creek	✗	N/a
Eulah Creek	NS	N/a
Bohena	✓	✓
Maules	✓	✓
Cox's Creek	✓	✓
Borah	NS	N/a
Bobbiwaa	✓	✓
Bundock	✓	✓
Brigalow	NS	N/a
Coghill	NS	N/a
Tallaba	✓	✓
Etoo	NS	N/a
Baradine	NS	N/a
Upper Pian	✓	✓
Lower Pian	✓	✓
Ginudgera	✓	✓
Box Creek	NS	N/a
Bugilbone	NS	N/a

Key: ✓ yes
 ✗ not known to be present
 NS not surveyed - *Lippia*'s presence and impact was not established.
 N/a not applicable

The Lake Keepit State Park consists of a total area of 1,200 ha, at the time of the study approximately 400 ha of water was present. Of the remaining area 30 to 40% was estimated to be covered by Lippia, almost the entire area to the high water mark of the dam consisted of 100% Lippia cover. Lippia was also present in small patches in the adjacent woodland area and covered extensive areas of open grassland above the water line.

The occurrence of Lippia was more sporadic around Quirindi, Quilpoly Dam and in creek line below the dam. In the immediate area surrounding Quilpoly Dam approximately 10 hectares is covered by dense Lippia, predominantly on the northern shores and it has been observed to be moving into adjacent grazing land. On inspection, patches of Lippia were found to be establishing in gaps between dense kikuyu growth on the southern shore. Individual Lippia plants were also present in patches along the Quirindi Creek and other smaller creek lines in the area.

Central West – Castlereagh, Macquarie and Bogan

Although there has been significant development in terms of dam and weir construction throughout the Castlereagh, Macquarie and Bogan River network (DWR 1991) Lippia does not appear to be creating the problems in these catchments as it has in other areas, although it may simply be a matter of time. It is reported to be present on floodplains and waterways of Dubbo, Coonamble, Nyngan, Wellington and Warren and is common in gardens and parks within these towns. Lippia is also known to be widespread in the Macquarie Marshes.

The Macquarie Marshes, at the lower end of the Macquarie River in the central west of NSW, cover an area of 201,330 ha of which 18,000 ha is reserve recognised under the Ramsar Convention (Brock, 1997). From 1944 to 1993 the area of Macquarie Marshes was reduced to 40-50% of their original size as a result of flood diversions and weirs (Kingsford & Thomas, 1995). Lippia was initially recognised as present in the Marshes around 1985 and currently is estimated to cover 10% of the reserve area (Figure 6). In the 1997 Macquarie Marshes Land and Water Management plan Lippia was mentioned as being widespread in the reserve and its presence being a cause for some concern (Brock, 1997).

Lachlan

Lippia has been known to be present in the Lachlan catchment since the early 1980s although it has become an increasing problem since the 1990 flood. Lucy *et al.* (1995) reported Lippia as present in 20 of 133 sites in a survey of the lower Lachlan conducted by Roberts. Lippia occurs along the Lachlan from Cowra to Lake Cargelligo. It is less common around Hillston and below, although, the groundcover at the junction with the Murrumbidgee consisted of 100% Lippia. It occurs sporadically on river flats around Cowra but is largely suppressed by cultivation, a similar situation exists along the length east from Forbes. About 30km west of Forbes, at Jemalong and further to Condobolin, Lippia is creating a significant problem along rivers, creeks and floodplains.

From Jemalong, the Lachlan floods to Lake Cowal. In the 1990 (the last major) flood 15,400 ha of the Jemalong Irrigation District was inundated, this whole area now has Lippia present to some extent. Following minor flooding in 1996 and 1998 the density of Lippia has increased significantly. It is estimated at present a total of 25,000 ha of the area to Lake Cowal is affected by Lippia. It is also widespread around Lake Cargelligo and occurs infrequently around Lake Brewster.

Downstream of Hillston, in the lower Lachlan, Lippia is widespread in the Great Cumbung Swamp. Landholders in the Lower Lachlan towards Hay have expressed concern about the increase in Lippia in the region.

Murrumbidgee

Along the Murrumbidgee River Lippia is present from Gundagai to Balranald. It is widespread and increasing in wetlands along the length of the River. The density of Lippia has increased markedly around Narrandera and Leeton since the last wet season in 2000. Lippia is thought to have been introduced to the region to stabilise river banks although it has been used as a lawn species in the region for over 80 years. Specimens have also been collected from Deakin, a suburb of Canberra.

The biggest problems along the Murrumbidgee are in the Lowbidgee between Hay and Balranald, Lippia increases in density below the Maude Weir. The area supports extensive floodplains and interconnected wetlands. Lippia is causing major concern in the Nimmie-Caira area of the Lowbidgee. There are approximately 22,000 ha of protected land in the region and a larger area of redgum forest (Hutchings pers. comm.). Lippia is reported to occur throughout this area although, at the time of the study, the area was almost 100% bare with the exception of lignum shrubs. In upstream areas irrigated cropland limits the expression of Lippia. North of Griffith, the Lower Mirrool and Anders Creek systems are affected by Lippia.

In the western area of the catchment Lippia is generally confined to relatively narrow strips along the River banks, presumably due to the lower rainfall in these areas. An issue in the Murrumbidgee is the lack of awareness of Lippia. The majority of people contacted in the region were not aware of its presence and could not identify it.

Murray (including the Mallee, Lower Murray Darling and SA MDB)

Lippia occurs along the Murray River from Albury to Lake Alexandrina. It is infrequent on the river east of Cobram although it is present in lawns around Culcairn and occurs in some natural depressions. There is no evidence of Lippia spreading across the floodplain to any extent. It increases in frequency to the west, being relatively common from Echuca to Wentworth. Lippia is also present north of the Murray at Deniliquin.

Lippia occurs at high density along the banks of the Murray at Swan Hill and Tooleybuc. It was recorded as being widespread in Nyah State Forest in 1977 and currently provides 100% of the groundcover growing largely through deep forest litter across the entire area. It has also been recorded at Moulamein, on the Moulamein Creek. Further west it is common on the river from Euston to the South Australian border, although, varying in density from small patches to carpeted cover. Lippia is widespread around wetland areas near Wentworth such as Thegoa Lagoon at the junction of the Darling and Murray Rivers and Purda Billabong.

In the SA MDB Lippia is known to occur along the banks of the Murray and at relatively low frequency on floodplains at Renmark, Paringa, Berri and Barmera. The populations are reported to be relatively stable in this region, although a flood has not been recorded for almost 7 years. Lippia is also known to occur at Mannum and Victor Harbour on the Fleurieu Peninsula. Lippia is not perceived to be a problem to any extent in the SA MDB catchment.

Victorian Catchments

Lippia does not appear to create any significant problems with regard to agricultural production in any of the Victorian catchments although it is present in all.

Mallee

In addition to locations along the Murray previously mentioned Lippia has been observed at Ouyen, Walpeup, Red Cliffs, Kings Billabong (between Mildura and Red Cliffs), Piambie and Major Mitchell Lagoon.

Wimmera

Lippia has been recorded as occurring at Warracknabeal, north of Warracknabeal on the Yarriambiack Creek, Birchip, Wannon, Lake Crassy and west of St Arnaud near the Avon River in the Wimmera catchment.

North Central

In addition to locations along the Murray previously mentioned (i.e. Swan Hill, Nyah) large areas of Lippia were present on reserve land along the Lodden River and north of the town of Kerang. It has also been recorded at Lake Boort and Vinifera.

Goulburn – Broken

Lippia is a dominant component of the vegetation along Broken Creek west of Nathalia and around Numerkah. Its presence in the catchment has been recognised since the flood of the late 1950s. The total cover of Lippia along Broken Creek is not more than 10% at present. It has also been recorded at Shepparton and Benalla.

North – East

Small patches have been observed below Lake Hume.

Western NSW Catchments

The expansion of *Lippia* into catchments of western NSW has very likely been limited by the low average rainfall received in these areas. Its occurrence in the western region is restricted to gardens and wetter areas.

Lower Murray Darling

Lippia appears largely confined to the wetlands surrounding the junction of the Darling and the Murray Rivers in the region west of Wentworth. It is also present to the east on watercourses around Dareton and Buronga. There have been unconfirmed reports of *Lippia* being present on the lower Darling, however, in recent surveys of the river below Menindee Lakes it was not recorded.

Western

Around Narran Lakes and the Nature Reserve area *Lippia* is widespread, however, in the current drought its level of cover has been significantly reduced. It has also been recorded around Angledool on the Narran River. Small individual plants of *Lippia* are reported to occur on the Darling River at Bourke and also around Cobar. Its occurrence is very infrequent in these areas.

Western Queensland Catchments

As for the western catchments of NSW the expansion of *Lippia* into area of western Qld has very likely been limited by the regions relatively low average rainfall.

Maranoa – Balonne

Lippia is known to occur in the catchment in Miles, Roma, Surat and south to St George and Dirrambandi. Although it is widely distributed it generally occurs at relatively low density. However, one landholder reported it as occurring over 200 ha west of Roma. There are indications that *Lippia* is becoming an increasing concern over a wide area of the catchment. While it occurs predominantly along waterways it has been observed on higher ground above the water line. West of Roma it occurs on top of the catchment at Mt. Abundance along the Chinchinbilla Creek, along Bungi Wagani to the Balonne River.

Warrego – Paroo

Individual isolated *Lippia* plants have been reported along the Warrego River around Cunnamulla and Charleville.

Incidence of *Lippia* (*Phyla canescens*) outside the MDB

There are few reported observations of *Lippia* outside the Murray Darling Basin. In Queensland *Lippia* is noted as a potential problem in the Murgon Shire Council area. *Lippia* has been recorded as occurring on the Central Coast, north of Sydney and in Williamstown a coastal suburb of Melbourne and also in Adelaide. Both *Phyla canescens* and *Phyla nodiflora* were reported as present in gardens of Hobart, Tasmania as well as in areas around Perth, WA. A specimen was collected from the banks of the Broughton River west of Yacka in the mid north region of South Australia.

World distribution of *Lippia*

Phyla canescens is widespread and thought native to South America occurring from southern Ecuador, throughout Peru, Chile, Argentina, Uruguay, Paraguay and Bolivia. (Kennedy, 1992). It also occurs in California, Utah, Nevada and North Carolina in North America, Hawaii, Mexico, Spain, France, Italy, South Africa, Senegal, Algeria, Afghanistan, Botswana, Egypt, Guam and New Zealand. (Kennedy 1992). Kennedy (1992) reported only a single specimen of *Phyla canescens* recorded from Adelaide in 1960.

The scarcity of literature available referring specifically to *Phyla canescens* would suggest it does not generally present any significant problem where it occurs, although, confusion surrounding the taxonomy of the genus may be a contributing factor. *Phyla canescens* has been reported as becoming an increasing problem in waterways in France (Spenceley pers.comm.). Although, at least one paper (Mans & Hattigh 1992) refers to the rapid growth rate of *Lippia canescens* [*Phyla nodiflora*] and its ability to effectively compete with trees for nitrogen. *Phyla nodiflora* is listed as an invasive species presenting an environmental threat in Honolulu (Space *et al.* 2003). This characteristic of invasiveness is more often associated with *Phyla canescens*, locally at least.

The confusion that still clearly persists between these two closely related species makes it difficult to accurately assess information and data relating to *Phyla canescens*. Kennedy (1992) states *Phyla canescens* is easily distinguished from other *Phyla* species by its low growing habit which forms a dense cover. Certainly at the majority of sites inspected during the course of this project this dense, low growing habit was observed. However, observations during the course of this study indicated the species appears to be able to exhibit a degree of morphological plasticity, depending on the micro-environment in which it occurs.

At sites where high levels of litter was present on the soil surface or in woodland areas, elongated branches of *Lippia* grew well. Where *Lippia* occurred at low frequency in relatively dense pasture the individual plants present under these conditions exhibited a more upright habit. In the absence of reproductive material on these plants accurate species identification was difficult and the plants were assumed to be *Phyla canescens* on the basis of location and proximity to other known populations of *Phyla canescens*.

The most recent indications of the comparative distributions of *Phyla nodiflora* and *Phyla canescens* were reported by Munir (1993) and are reproduced in Figure 7 and Figure 8 respectively.

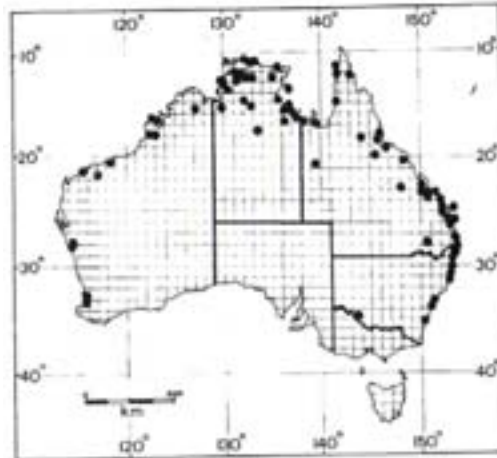


Figure 7. Distribution of *Phyla nodiflora* in Australia
Source: Munir, 1993

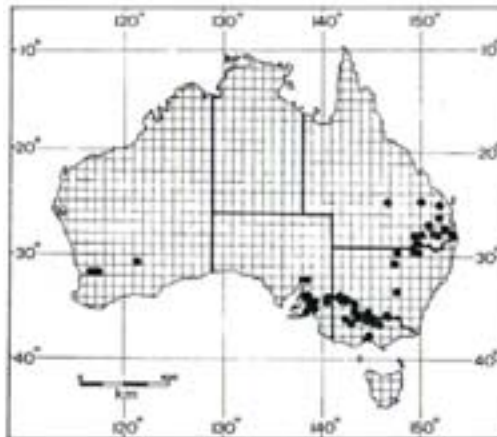


Figure 8. Distribution of *Phyla canescens* in Australia
Source: Munir, 1993

The confusion that still remains in the taxonomy of *Phyla* spp., at least in historical descriptions, requires clarification. A number of graziers indicated the apparent occurrence of at least two varieties on their properties. A total of 80 specimens were collected during the course of this study from a wide range of areas across the Murray Darling Basin. These specimens could provide valuable resource material to determine the extent of the taxonomic variation that exists within the species.