Supporting Information

A global assessment of Holistic Planned Grazing™ compared with season-long, continuous grazing: meta-analysis findings
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Table S1: The means, standard deviations and Quality Indices (Qi) for data sets comparing plant cover (basal cover except where noted otherwise), plant biomass, animal gain (or production in kg ha\(^{-1}\)) and animal average daily gain (or condition in kg head\(^{-1}\) d\(^{-1}\)) for Holistic Planned Grazing™ (HPG) and season-long continuous grazing are given in the context of the location and Aridity Index (AI). Peer-reviewed studies were selected that included comparisons between HPG and season-long continuous grazing at set stocking rates. The coordinates provided by some studies were approximate. Source of the AI data: CGIAR-CSI Global-Aridity and Global-PET Database, http://www.cgiar-csi.org, Zomer et al. (2007, 2008). Full citations of the studies can be found in the References of the main article.

| Data set (first author, year, details) | Data type | Lat. | Long. | AI | Country | Time (yrs) | Size (n) | Mean | SD  | Mean | SD  | Qi | Qi calculation (refer Table 1) |
|--------------------------------------|-----------|------|-------|----|---------|------------|---------|------|-----|------|-----|----|-----------------------------|
| Badgery 2016a (dry yrs, low prod.)   | Plant cover | 33.450 | 148.933 | 0.684 | Australia | 4 | 3 | 82.94 | 0.904 | 83.50 | 0.736 | 0.81 | 1+1+2+1+0.5+1 |
| Badgery 2016a (dry yrs, med. prod.) | Plant cover | 33.450 | 148.933 | 0.684 | Australia | 4 | 3 | 92.13 | 0.688 | 85.75 | 2.175 | 0.81 | 1+1+2+1+0.5+1 |
| Badgery 2016a (dry yrs, high prod.) | Plant cover | 33.450 | 148.933 | 0.684 | Australia | 4 | 3 | 99.13 | 0.239 | 91.88 | 1.028 | 0.81 | 1+1+2+1+0.5+1 |
| Badgery 2016a wet yrs, low prod.)   | Plant cover | 33.450 | 148.933 | 0.684 | Australia | 4 | 3 | 93.50 | 3.926 | 93.50 | 3.926 | 0.81 | 1+1+2+1+0.5+1 |
| Badgery 2016a wet yrs, med. prod.)  | Plant cover | 33.450 | 148.933 | 0.684 | Australia | 4 | 3 | 97.25 | 1.931 | 94.00 | 3.373 | 0.81 | 1+1+2+1+0.5+1 |
| Badgery 2016a (wet yrs, high prod.) | Plant cover | 33.450 | 148.933 | 0.684 | Australia | 4 | 3 | 99.13 | 0.427 | 96.25 | 2.278 | 0.81 | 1+1+2+1+0.5+1 |
| Clatworthy 1984 (S1)                | Plant cover | 18.192 | 31.542 | 0.624 | Zimbabwe | 7 | 7 | 43.71 | 16.449 | 38.43 | 8.867 | 0.38 | 0+0+2+1+0+0 |
| Clatworthy 1984 (S2)                | Plant cover | 18.192 | 31.542 | 0.624 | Zimbabwe | 7 | 7 | 45.00 | 13.191 | 41.00 | 14.714 | 0.38 | 0+0+2+1+0+0 |
| Dowling 2005 (Guyra)               | Plant cover | 30.200 | 151.666 | 0.610 | Australia | 6 | 6 | 17.42 | 3.890 | 15.88 | 3.365 | 0.81 | 1+1+2+1+0.5+1 |
| Dowling 2005 (Armidale)            | Plant cover | 30.514 | 151.666 | 1.069 | Australia | 4 | 4 | 11.13 | 3.944 | 7.06 | 3.489 | 0.81 | 1+1+2+1+0.5+1 |
| Dowling 2005 (Newbridge)           | Plant cover | 33.589 | 149.380 | 0.766 | Australia | 6 | 6 | 9.71 | 4.530 | 8.96 | 4.109 | 0.88 | 1+1+2+1+1+1 |
| Dowling 2005 (Tarago)              | Plant cover | 35.069 | 149.654 | 0.610 | Australia | 6 | 3 | 2.73 | 1.519 | 2.02 | 1.845 | 0.81 | 1+1+2+1+0.5+1 |
| Dowling 2005 (Oatlands)            | Plant cover | 42.300 | 147.371 | 1.069 | Australia | 3 | 3 | 7.79 | 3.684 | 7.57 | 2.835 | 0.88 | 1+1+2+1+1+1 |
| Derner 2007                        | Plant cover | 40.817 | -107.767 | 0.352 | USA | 2 | 3 | 15.56 | 2.185 | 21.80 | 4.950 | 0.75 | 1+1+2+0+1+1 |
| Data set (first author, year, details) | Data type               | Lat.  | Long.     | AI      | Country | Time (yrs) | Size (n) | Mean (SD) | Mean (SD) | Qi (refer Table 1) |
|--------------------------------------|-------------------------|-------|-----------|---------|----------|------------|----------|-----------|-----------|---------------------|
| Derner 2007 (foliar cover)           | Plant cover             | 40.817| -107.767  | 0.352   | USA      | 2          | 3        | 64.10 (2.546) | 68.40 (3.536) | 0.75 1+1+2+0+1+1+1 |
| Hart 1988                            | Plant cover             | 41.183| -103.117  | 0.367   | USA      | 6          | 6        | 74.00 (5.000) | 69.00 (5.000) | 0.69 1+0.5+2+1+0+1 |
| Jacobo 2006 (highland)               | Plant cover             | -36.000| -64.000   | 0.463   | Argentina| 4          | 4        | 81.50 (9.000) | 82.75 (2.062) | 0.94 2+1+2+0+1+1+1 |
| Jacobo 2006 (lowland)                | Plant cover             | -36.000| -64.000   | 0.463   | Argentina| 4          | 4        | 86.00 (5.099) | 76.25 (9.743) | 0.94 2+1+2+0+1+1+1 |
| Manley 1997 (mod/heavy stocking)     | Plant cover             | 41.183| -104.883  | 0.372   | USA      | 6          | 12       | 15.00 (5.000) | 15.00 (5.000) | 0.94 2+0.5+2+1+1+1 |
| Manley 1997                          | Plant cover             | 41.183| -104.883  | 0.372   | USA      | 6          | 13       | 11.15 (4.598) | 9.88 (3.618)  | 0.69 2+0.5+2+1+1+1 |
| Teague 2011                          | Plant cover             | 33.267| -98.133   | 0.542   | USA      | 7          | 9        | 99.00 (5.000) | 100.00 (5.000) | 0.63 2+0+0+1+1+1 |
| Thurow 1988 (forb foliar cover)      | Plant cover             | 31.000| -100.000  | 0.378   | USA      | 3          | 3        | 2.53 (1.357)  | 4.67 (2.529)  | 0.56 1+1+0.5+1+1+1 |
| Thurow 1988 (grass foliar cover)     | Plant cover             | 31.000| -100.000  | 0.378   | USA      | 3          | 3        | 14.64 (2.335) | 16.73 (1.849) | 0.56 1+1+0.5+1+1+1 |
| White 1991 (Yr1)                     | Plant cover             | 33.352| -105.592  | 0.341   | USA      | 2          | 40       | 13.30 (5.123) | 12.90 (2.909) | 0.44 2+0.5+0+0+0+1 |
| White 1991 (Yr2)                     | Plant cover             | 33.352| -105.592  | 0.341   | USA      | 2          | 40       | 12.40 (3.542) | 11.60 (2.340) | 0.44 2+0.5+0+0+0+1 |
| Anderson 1988 (Yr1)                  | Plant biomass           | 32.483| -106.733  | 0.160   | USA      | 1          | 2        | 832.00 (207.000) | 833.00 (225.000) | 0.56 1+0.5+1+0+1+1+1 |
| Anderson 1988 (Yr2)                  | Plant biomass           | 32.483| -106.733  | 0.160   | USA      | 2          | 2        | 711.00 (78.000) | 1109.00 (78.000) | 0.56 1+0.5+1+0+1+1+1 |
| Badgery 2016a (dry yrs, low prod.)   | Plant biomass           | -33.450| 148.933   | 0.684   | Australia| 4          | 3        | 1312.50 (12.500) | 1125.00 (75.000) | 0.81 1+1+2+1+0.5+1 |
| Badgery 2016a (dry yrs, med. prod.)  | Plant biomass           | -33.450| 148.933   | 0.684   | Australia| 4          | 3        | 1650.00 (86.603) | 1112.50 (129.703) | 0.81 1+1+2+1+0.5+1 |
| Badgery 2016a (dry yrs, high prod.)  | Plant biomass           | -33.450| 148.933   | 0.684   | Australia| 4          | 3        | 2275.00 (149.304) | 1475.00 (110.868) | 0.81 1+1+2+1+0.5+1 |
| Badgery 2016a wet yrs, low prod.)    | Plant biomass           | -33.450| 148.933   | 0.684   | Australia| 4          | 3        | 2775.00 (532.877) | 2425.00 (366.003) | 0.81 1+1+2+1+0.5+1 |
| Badgery 2016a wet yrs, med. prod.)   | Plant biomass           | -33.450| 148.933   | 0.684   | Australia| 4          | 3        | 2975.00 (444.175) | 2525.00 (417.083) | 0.81 1+1+2+1+0.5+1 |
| Badgery 2016a wet yrs, high prod.)   | Plant biomass           | -33.450| 148.933   | 0.684   | Australia| 4          | 3        | 3475.00 (464.354) | 2950.00 (427.200) | 0.81 1+1+2+1+0.5+1 |
| Cassels 1995                         | Plant biomass           | 36.067| -99.217   | 0.493   | USA      | 5          | 5        | 3600.00 (360.000) | 3000.00 (360.000) | 0.75 1+0.5+2+0.5+1+1+1 |
| Dowling 2005 (Guyra)                 | Plant biomass           | -30.200| 151.666   | 0.610   | Australia| 6          | 6        | 4896.67 (1408.526) | 5121.67 (1299.806) | 0.81 1+1+2+1+0.5+1 |
| Dowling 2005 (Armidale)              | Plant biomass           | -30.514| 151.666   | 1.069   | Australia| 4          | 4        | 6207.50 (3603.992) | 6445.00 (2940.981) | 0.81 1+1+2+1+0.5+1 |
| Dowling 2005 (Newbridge)             | Plant biomass           | -33.589| 149.380   | 0.766   | Australia| 6          | 6        | 5921.67 (2493.395) | 5808.33 (1496.722) | 0.88 1+1+2+1+1+1+1 |
| Dowling 2005 (Tarago)                | Plant biomass           | -35.069| 149.654   | 0.610   | Australia| 6          | 6        | 4790.00 (1489.872) | 3980.00 (1712.157) | 0.81 1+1+2+1+0.5+1 |
| Dowling 2005 (Oatlands)              | Plant biomass           | -42.300| 147.371   | 1.069   | Australia| 3          | 3        | 3066.67 (1339.602) | 2506.67 (1053.391) | 0.88 1+1+2+1+1+1+1 |
| Gammon 1978                          | Plant biomass           | -20.132| 28.626    | 0.370   | Zimbabwe | 2          | 4        | 1989.33 (493.622) | 1945.00 (658.021)  | 0.56 1+0.5+2+0+0+1 |
| Data set (first author, year, details) | Data type           | Lat.  | Long.   | AI    | Country | Time (yrs) | Size (n) | Mean  | SD    | Mean  | SD    | Qi    | Qi calculation (refer Table 1) |
|--------------------------------------|---------------------|-------|---------|-------|----------|------------|----------|-------|-------|-------|-------|-------|--------------------------------|
| Gillen 1998                          | Plant biomass       | 36.367| -99.067 | 0.477 | USA      | 5          | 6        | 2716.67| 584.523| 2466.67| 602.218| 0.94 | 2+1+2+0.5+1+1               |
| Manley 1997                          | Plant biomass       | 41.183| -104.883| 0.372 | USA      | 6          | 4        | 1047.50| 472.961| 1200.00| 511.534| 0.94 | 2+0.5+2+1+1+1               |
| Teague 2010 (grass, loam)            | Plant biomass       | 33.267| -98.133 | 0.542 | USA      | 7          | 7        | 1868.00| 89.956 | 1835.00| 103.184| 0.88 | 1+0.5+0+1+1+1               |
| Teague 2010 (grass, clay-loam)       | Plant biomass       | 33.267| -98.133 | 0.542 | USA      | 7          | 7        | 1264.00| 100.539| 1338.00| 95.247 | 0.88 | 1+0.5+0+1+1+1               |
| Teague 2010 (grass, clay)            | Plant biomass       | 33.267| -98.133 | 0.542 | USA      | 7          | 7        | 908.00 | 52.915 | 940.00 | 63.498 | 0.88 | 1+0.5+0+1+1+1               |
| Teague 2010 (forb, loam)             | Plant biomass       | 33.267| -98.133 | 0.542 | USA      | 7          | 7        | 416.00 | 44.978 | 450.00 | 55.561 | 0.88 | 1+0.5+0+1+1+1               |
| Teague 2010 (forb, clay-loam)        | Plant biomass       | 33.267| -98.133 | 0.542 | USA      | 7          | 7        | 299.00 | 52.915 | 343.00 | 47.624 | 0.88 | 1+0.5+0+1+1+1               |
| Teague 2010 (forb, clay)             | Plant biomass       | 33.267| -98.133 | 0.542 | USA      | 7          | 7        | 272.00 | 31.749 | 318.00 | 39.686 | 0.88 | 1+0.5+0+1+1+1               |
| Teague 2011                          | Plant biomass       | 33.267| -98.133 | 0.542 | USA      | 1          | 3        | 4680.00| 470.000| 2696.00| 270.000| 0.75 | 2+0.5+0+1+1+1               |
| Thurow 1988                          | Plant biomass       | 31.000| -100.000| 0.378 | USA      | 3          | 3        | 2040.91| 347.000| 2013.64| 394.393| 0.56 | 1+1+0+0.5+1+1               |
| Vermeire 2008                        | Plant biomass       | 46.367| -105.083| 0.366 | USA      | 6          | 4        | 1310.00| 180.000| 1406.00| 180.000| 0.94 | 2+1+2+0.5+1+1               |
| White 1991                           | Plant biomass       | 33.352| -105.592| 0.341 | USA      | 2          | 6        | 1214.14| 242.509| 1199.14| 173.027| 0.63 | 2+1+0+0+1+1               |
| Anderson 1988 (Yr1)                  | Animal gain         | 32.483| -106.733| 0.160 | USA      | 1          | 3        | 200.00 | 4.000  | 244.00 | 2.000  | 0.56 | 1+0.5+1+0+1+1               |
| Anderson 1988 (Yr2)                  | Animal gain         | 32.483| -106.733| 0.160 | USA      | 2          | 3        | 252.00 | 1.000  | 240.00 | 1.000  | 0.56 | 1+0.5+1+0+1+1               |
| Badgerly 2016b (pregnant ewes)       | Animal gain         | -33.450| 148.933 | 0.684 | Australia| 4          | 3        | 306.51 | 36.781 | 271.76 | 32.611 | 0.81 | 1+1+2+1+0.5+1               |
| Clatworthy 1984 (S1)                 | Animal gain         | -18.192| 31.542  | 0.624 | Zimbabwe | 7          | 7        | 157.04 | 11.613 | 125.76 | 9.883  | 0.38 | 0+0+2+1+0+0                |
| Clatworthy 1984 (S2)                 | Animal gain         | -18.192| 31.542  | 0.624 | Zimbabwe | 7          | 7        | 232.86 | 15.040 | 151.19 | 9.879  | 0.38 | 0+0+2+1+0+0                |
| Derner 2008                          | Animal gain         | 41.183| -104.883| 0.352 | USA      | 9          | 14       | 99.29  | 26.374 | 100.71 | 21.200 | 1.00 | 2+1+2+1+1+1               |
| Hart 1988                            | Animal gain         | 41.183| -104.883| 0.372 | USA      | 6          | 2        | 75.56  | 14.240 | 84.11  | 15.831 | 0.69 | 1+0.5+2+1+0+1               |
| McCollum 1999                        | Animal gain         | 36.367| -99.067 | 0.477 | USA      | 6          | 6        | 100.83 | 8.232  | 115.83 | 5.601  | 0.94 | 2+0.5+2+1+1+1               |
| Anderson 1988 (Yr1)                  | Animal condition    | 32.483| -106.733| 0.160 | USA      | 1          | 3        | 0.08   | 0.040  | 0.17   | 0.030  | 0.56 | 1+0.5+1+0+1+1               |
| Anderson 1988 (Yr2)                  | Animal condition    | 32.483| -106.733| 0.160 | USA      | 2          | 3        | 0.29   | 0.040  | 0.38   | 0.050  | 0.56 | 1+0.5+1+0+1+1               |
| Badgerly 2016b (pregnant ewes)       | Animal condition    | -33.450| 148.933 | 0.684 | Australia| 4          | 3        | 0.16   | 0.020  | 0.17   | 0.016  | 0.81 | 1+1+2+1+0.5+1               |
| Derner 2007                          | Animal condition    | 40.817| -107.767| 0.352 | USA      | 9          | 10       | 1.03   | 0.111  | 1.05   | 0.087  | 0.75 | 1+1+2+1+0+0                |
| Derner 2008 (dry yr)                 | Animal condition    | 41.183| -104.883| 0.372 | USA      | 9          | 16       | 0.82   | 0.400  | 0.81   | 0.400  | 1.00 | 2+1+2+1+1+1               |
| Derner 2008 (avg yr)                 | Animal condition    | 41.183| -104.883| 0.372 | USA      | 9          | 16       | 0.83   | 0.250  | 0.88   | 0.250  | 1.00 | 2+1+2+1+1+1               |
| Data set (first author, year, details) | Data type       | Lat.   | Long.     | AI   | Country | Time (yrs) | Size (n) | Mean    | SD    | Mean    | SD    | QI               | Qi calculation (refer Table 1) |
|---------------------------------------|-----------------|--------|-----------|------|---------|------------|----------|---------|-------|---------|-------|------------------|-----------------------------|
| Derner 2008 (wet yr)                  | Animal condition| 41.183 | −104.883  | 0.372| USA     | 9          | 16       | 0.88    | 0.350 | 0.91    | 0.350 | 1.00             | 2+1+2+1+1+1+1               |
| Hart 1988                             | Animal condition| 41.183 | −104.883  | 0.372| USA     | 6          | 6        | 0.73    | 0.189 | 0.87    | 0.202 | 0.69             | 1+1+1+1+0.5+1               |
| Hart 1993b (nursing cows)             | Animal condition| 41.183 | −104.883  | 0.372| USA     | 7          | 5        | 0.42    | 0.152 | 0.24    | 0.130 | 0.69             | 1+1+1+1+0.5+1               |
| Hart 1993b (dry cows)                 | Animal condition| 41.183 | −104.883  | 0.372| USA     | 7          | 5        | 0.67    | 0.130 | 0.67    | 0.160 | 0.69             | 1+1+1+1+0.5+1               |
| Hart 1993b (calves)                   | Animal condition| 41.183 | −104.883  | 0.372| USA     | 7          | 5        | 0.86    | 0.075 | 0.77    | 0.086 | 0.69             | 1+1+1+1+0.5+1               |
| Hart 1993b (heifers)                  | Animal condition| 41.183 | −104.883  | 0.372| USA     | 7          | 5        | 0.73    | 0.101 | 0.66    | 0.111 | 0.69             | 1+1+1+1+0.5+1               |
| Heidschmidt 1982                      | Animal condition| 33.333 | −99.233   | 0.468| USA     | 2          | 10       | 0.58    | 0.329 | 0.58    | 0.358 | 0.38             | 1+0+2+0+0+0                 |
| Manley 1997                           | Animal condition| 41.183 | −104.883  | 0.372| USA     | 6          | 7        | 0.76    | 0.100 | 0.88    | 0.090 | 0.69             | 1+0.5+1+0.5+1+1              |
| McCollum 1999                         | Animal condition| 36.367 | −99.067   | 0.477| USA     | 3          | 6        | 0.33    | 0.060 | 0.29    | 0.034 | 0.94             | 2+0.5+2+1+1+1               |
Table S2: Assumptions and weightings assigned to the fixed- (FE), random- (RE) and quality effects (QE) models.

| Model | FE | RE | QE |
|-------|----|----|----|
| **Main assumption** | Studies are from one population | Studies are from different populations | Studies are from different populations |
| **Calculation of effect size at \( p = 0.05 \) level** | Difference in means between treatment \( (\bar{x}_t) \) and the control \( (\bar{x}_c) \) as: \[
\frac{\bar{x}_t - \bar{x}_c}{\bar{x}_c} \times 100 \]
| As for FE | As for FE | As for FE |
| **Assumed source of error/s** | Sampling error | As for FE; plus heterogeneity between studies | As for FE; plus heterogeneity between studies |
| **Weighting** | High weighting for studies with small standard errors | As for FE, plus a random term based on between-study heterogeneity | As for FE, plus a Quality Index (Qi) based on study design |
| **Criticism** | Assumes different studies are one populations | Random term is applied equally across studies regardless of quality | Qi is sensitive to user-defined criteria |
| **References** | Lipsey and Wilson (2001); Senn (2007) | Senn (2007) | Doi and Thalib (2008, 2009) |