1
00:00:17,300 --> 00:00:13,220
the food we eat has changed a great deal

2
00:00:21,519 --> 00:00:17,310
in the last century from the kind of

3
00:00:23,839 --> 00:00:21,529
food we grow to the farms it's grown on

4
00:00:28,940 --> 00:00:23,849
to the process of getting it from

5
00:00:32,930 --> 00:00:30,890
but one of the biggest changes to global

6
00:00:36,110 --> 00:00:32,940
agriculture isn't so much about the food

7
00:00:39,290 --> 00:00:36,120
itself it's about the water we use to

8
00:00:41,960 --> 00:00:39,300
grow it over the past century we've gone

9
00:00:44,780 --> 00:00:41,970
from a situation where farmers dependent

10
00:00:47,990 --> 00:00:44,790
almost exclusively on rainfall for their

11
00:00:51,320 --> 00:00:48,000
crops to a realization that they could

12
00:00:53,990 --> 00:00:51,330
use irrigation to maximize crop output

13
00:00:55,549 --> 00:00:54,000

and grow crops in areas that may be too

14
00:00:59,060 --> 00:00:55,559
dry or where they would naturally be

15
00:01:01,700 --> 00:00:59,070
able to grow that shift comes with new

16
00:01:03,500 --> 00:01:01,710
responsibilities in some areas people

17
00:01:08,660 --> 00:01:03,510
are using water faster than its being

18
00:01:13,900 --> 00:01:08,670
replenished NASA satellites help us see

19
00:01:17,510 --> 00:01:13,910
how water moves from ocean to atmosphere

20
00:01:20,840 --> 00:01:17,520
to land where we harness it for growing

21
00:01:22,910 --> 00:01:20,850
food the big picture view they provide

22
00:01:25,820 --> 00:01:22,920
helps us understand how our water needs

23
00:01:30,639 --> 00:01:25,830
are being met today and where we might

24
00:01:35,150 --> 00:01:32,990
increasingly we're tapping into ground

25
00:01:39,260 --> 00:01:35,160
water from underground aquifers to meet

26
00:01:42,320 --> 00:01:39,270
our demand these aquifers vast regions

27
00:01:44,180 --> 00:01:42,330
of water saturated earth can be huge but

28
00:01:47,570 --> 00:01:44,190
hidden underground they're difficult to

29
00:01:53,199 --> 00:01:47,580
observe how do you study what you can't

30
00:01:58,550 --> 00:01:56,359
pair of satellites called grace is on a

31
00:02:00,380 --> 00:01:58,560
special mission they're carefully

32
00:02:03,680 --> 00:02:00,390
mapping delicate variations in the

33
00:02:06,109 --> 00:02:03,690
Earth's gravity our planets gravity

34
00:02:08,690 --> 00:02:06,119
isn't the same everywhere objects with

35
00:02:11,690 --> 00:02:08,700
larger mass mountain ranges for instance

36
00:02:14,160 --> 00:02:11,700
exert a stronger pull

37
00:02:18,660 --> 00:02:14,170
so two huge bodies of water like

38
00:02:20,520 --> 00:02:18,670

aquifers as the grace satellites orbit

39
00:02:22,290 --> 00:02:20,530
together large objects affect the

40
00:02:23,850 --> 00:02:22,300
leading satellite before they affect the

41
00:02:26,190 --> 00:02:23,860
trailing one causing the distance

42
00:02:28,590 --> 00:02:26,200
between to vary by taking continuous

43
00:02:30,390 --> 00:02:28,600
measurements of that distance scientists

44
00:02:33,270 --> 00:02:30,400
can map the Earth's gravity field and

45
00:02:35,610 --> 00:02:33,280
see how it changes over time and over

46
00:02:37,260 --> 00:02:35,620
land the major cause of that variability

47
00:02:39,900 --> 00:02:37,270
is changes in the amount of ground water

48
00:02:42,120 --> 00:02:39,910
grace effectively feels those changes by

49
00:02:44,100 --> 00:02:42,130
monitoring gravity changes in

50
00:02:45,960 --> 00:02:44,110
groundwater are actually sensed by grace

51
00:02:47,880 --> 00:02:45,970
and we can come up with asked of the

52
00:02:51,630 --> 00:02:47,890
water table variations and that's what

53
00:02:54,090 --> 00:02:51,640
we did for Northwest India in India

54
00:02:56,699 --> 00:02:54,100
water hungry farms in the nation's North

55
00:03:00,360 --> 00:02:56,709
draw 95% of their water from ground

56
00:03:03,690 --> 00:03:00,370
water stores since grace is launched in

57
00:03:05,810 --> 00:03:03,700
2002 aquifers beneath Northwest India

58
00:03:08,550 --> 00:03:05,820
have lost a staggering amount of water

59
00:03:11,250 --> 00:03:08,560
three times as much water as is held in

60
00:03:16,410 --> 00:03:11,260
Lake Mead America's largest reservoir is

61
00:03:18,120 --> 00:03:16,420
gone the people of India know this is

62
00:03:20,100 --> 00:03:18,130
happening they know this because their

63
00:03:21,990 --> 00:03:20,110

wells occasionally run dry and if you

64
00:03:24,390 --> 00:03:22,000
dig a deeper well in some cities the

65
00:03:26,699 --> 00:03:24,400
wells are running dry so fast that

66
00:03:28,319 --> 00:03:26,709
people spend their entire day trying to

67
00:03:31,319 --> 00:03:28,329
find a clean source of water for their

68
00:03:33,449 --> 00:03:31,329
for their family if the aquifer

69
00:03:35,880 --> 00:03:33,459
continues to decline the region's

70
00:03:39,000 --> 00:03:35,890
agriculture faces an uncertain future as

71
00:03:43,949 --> 00:03:39,010
do the almost 115 million people who

72
00:03:45,900 --> 00:03:43,959
live there India is not alone other

73
00:03:48,180 --> 00:03:45,910
major aquifers like those beneath

74
00:03:51,539 --> 00:03:48,190
northern China and the central US are

75
00:03:53,400 --> 00:03:51,549
also in decline water is critical to

76
00:03:55,500 --> 00:03:53,410
people minutes of it's a vital resource

77
00:03:57,449 --> 00:03:55,510
obviously so being able to understand

78
00:03:59,220 --> 00:03:57,459
the water cycle and how it's changing is

79
00:04:01,920 --> 00:03:59,230
important as we move forward in the

80
00:04:03,930 --> 00:04:01,930
highly populated world with potential

81
00:04:06,240 --> 00:04:03,940
climate change going on and

82
00:04:08,789 --> 00:04:06,250
NASA satellite survey shion's are

83
00:04:12,000 --> 00:04:08,799
extremely valuable to getting an

84
00:04:15,309 --> 00:04:12,010
unbiased view of what's going on with

85
00:04:20,319 --> 00:04:17,439
Water Resources will become even more

86
00:04:21,879 --> 00:04:20,329
scarce in the coming century the grace

87
00:04:24,400 --> 00:04:21,889
satellites can't help us recoup what

88
00:04:27,070 --> 00:04:24,410

we've lost but they do give us something

89
00:04:29,740 --> 00:04:27,080
valuable knowledge we can use to shape